CALIFORNIA RADIO INTEROPERABILITY SYSTEM

- What the State of California doing
- Currently in operation plus what is planned
- RF Site selection and buildout methods
- Provisions for load management
- Dispatch and interoperability challenges and options

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CALIFORNIA RADIO INTEROPERABILITY SYSTEM

BCP

- 5 Year Program - $59.5million

- Initial Deployment
  - Central Valley
    - 6 sites / 6 months

- Year Two Deployment Under Development
  - Enhanced Capitol Area Coverage (Completed May 2020)
  - I-5 North of Sacramento (planned July 31, 2020)
  - Bay Area Coverage (planned December 2020)
  - LA/Ventura/Orange (planned June 2021)

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California Radio Interoperable System (CRIS)
5-Year Roadmap

Budget Year	Project Phase	Region	% Cumulative Geo.	% Cumulative Pop.
2019-20	Phase 1	Central Valley	12%	16%
2020-21	Phase 2	North Valley	30%	55%
		Bay Area		
		LA/Ventura/Orange		
2021-22	Phase 3	Central Coast	45%	70%
2022-23	Phase 4	Northern Coast	50%	85%
		Southern Border		
2023-34	Phase 5	Inland/Others	60%	90%

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STATE OF CALIFORNIA

CALIFORNIA GOVERNOR'S OFFICE OF EMERGENCY SERVICES
CALIFORNIA RADIO INTEROPERABILITY SYSTEM
DEPLOYMENT MAP

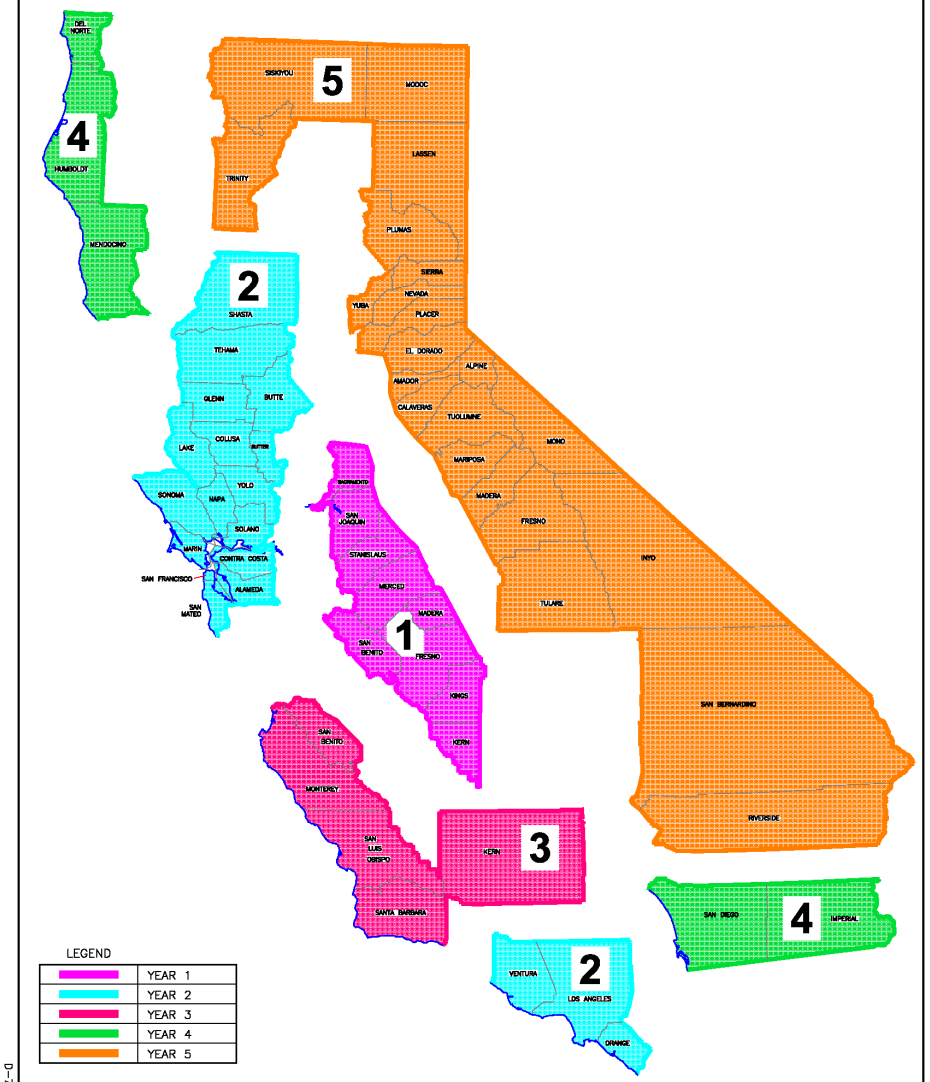

TABLE OF CHANGES

SYSTEM DIAGRAM
CALIFORNIA RADIO INTEROPERABILITY SYSTEM
DEPLOYMENT MAP

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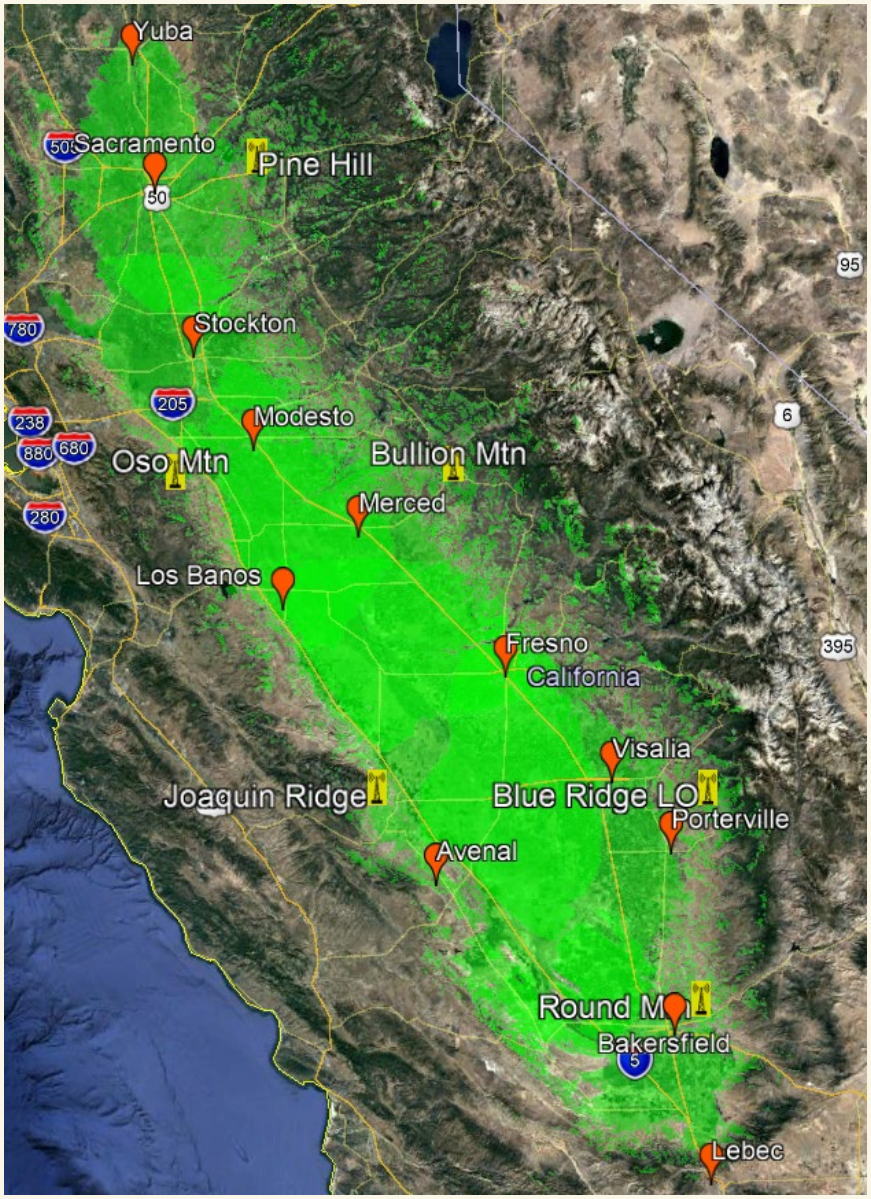
CRIS - INITIAL DEPLOYMENT - CENTRAL VALLEY DECEMBER 2019



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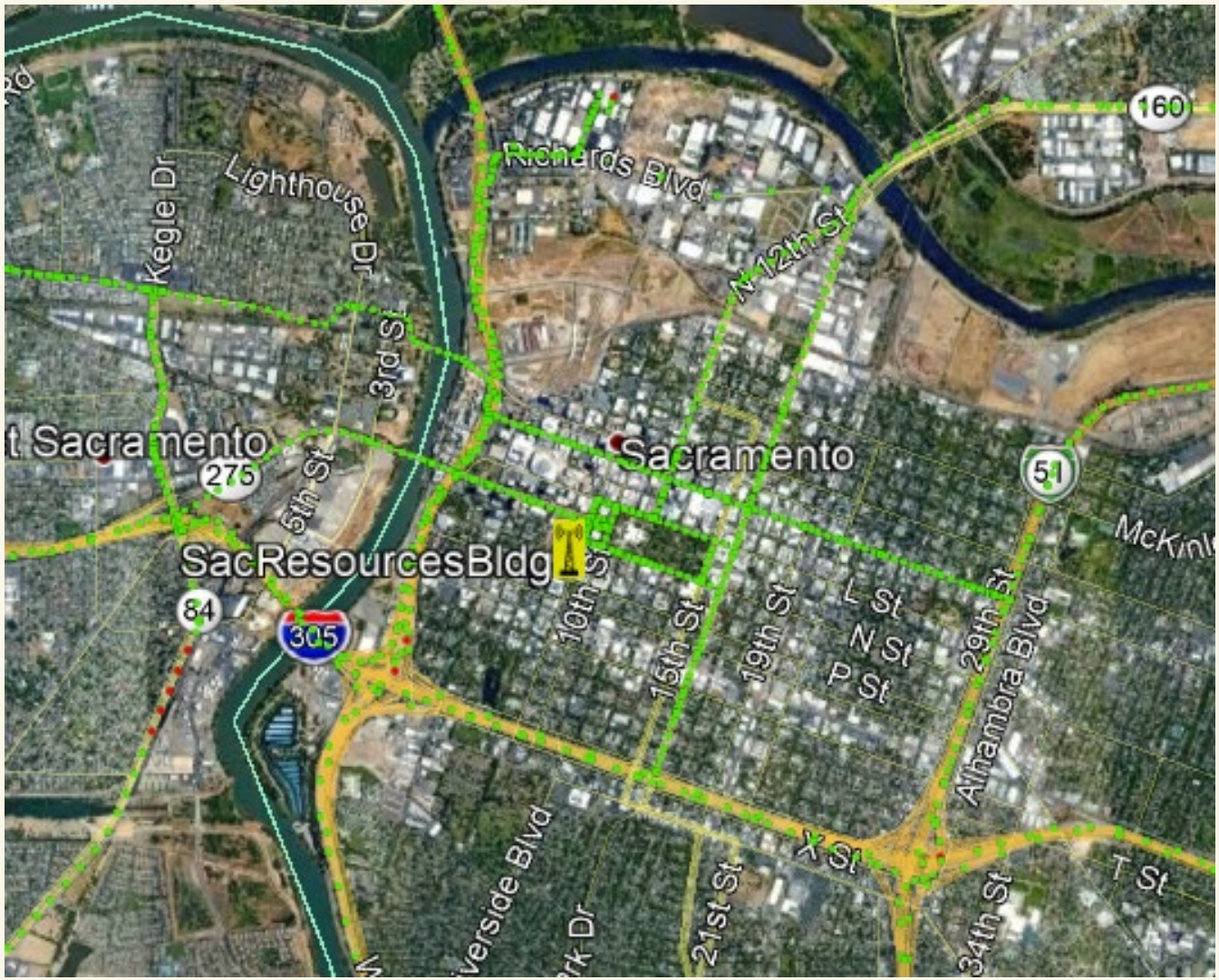
CRIS – DOWNTOWN SACRAMENTO RADIO SURVEY MAY 2020



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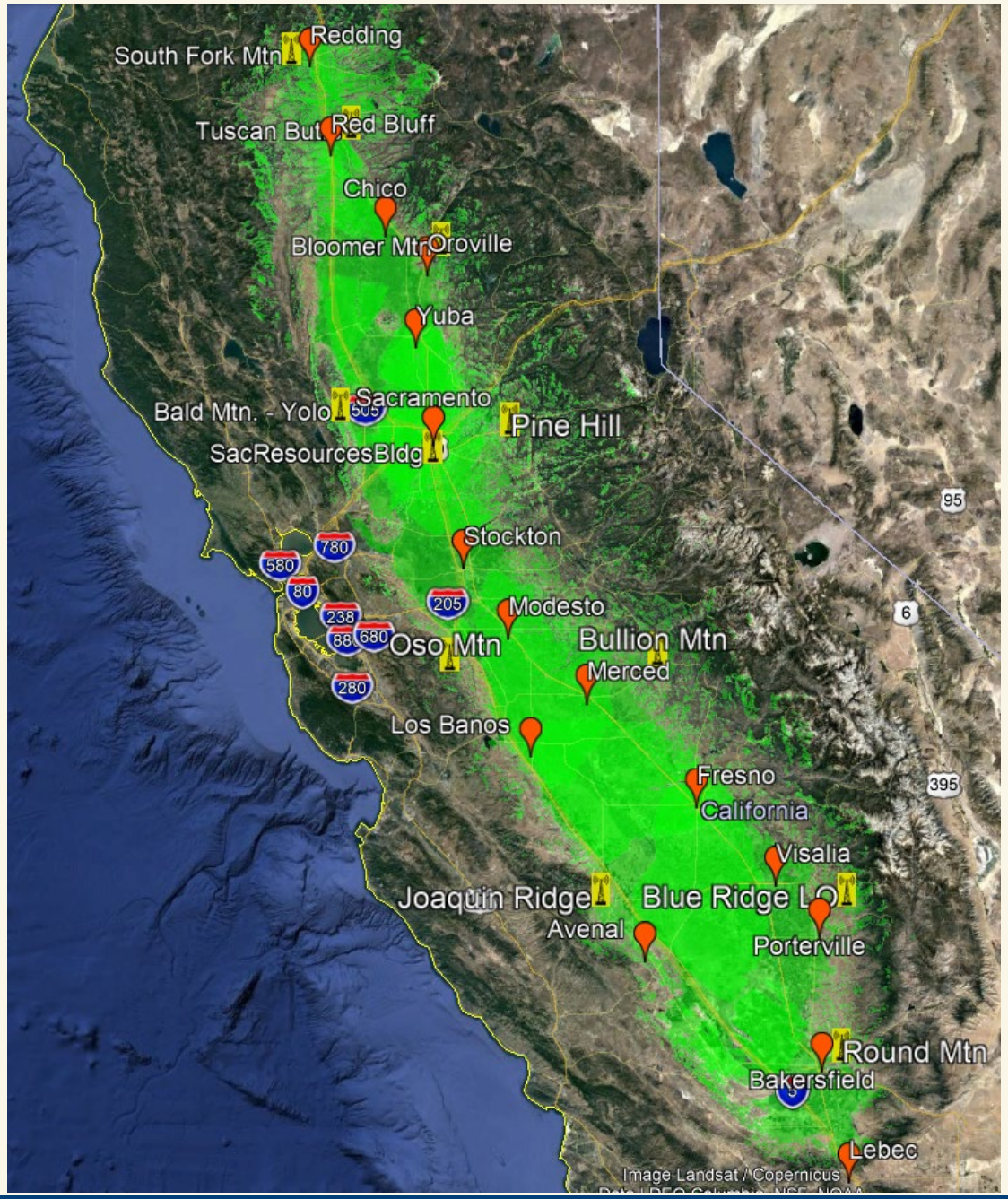
CRIS – EXPECTED VALLEY COVERAGE JULY 2020



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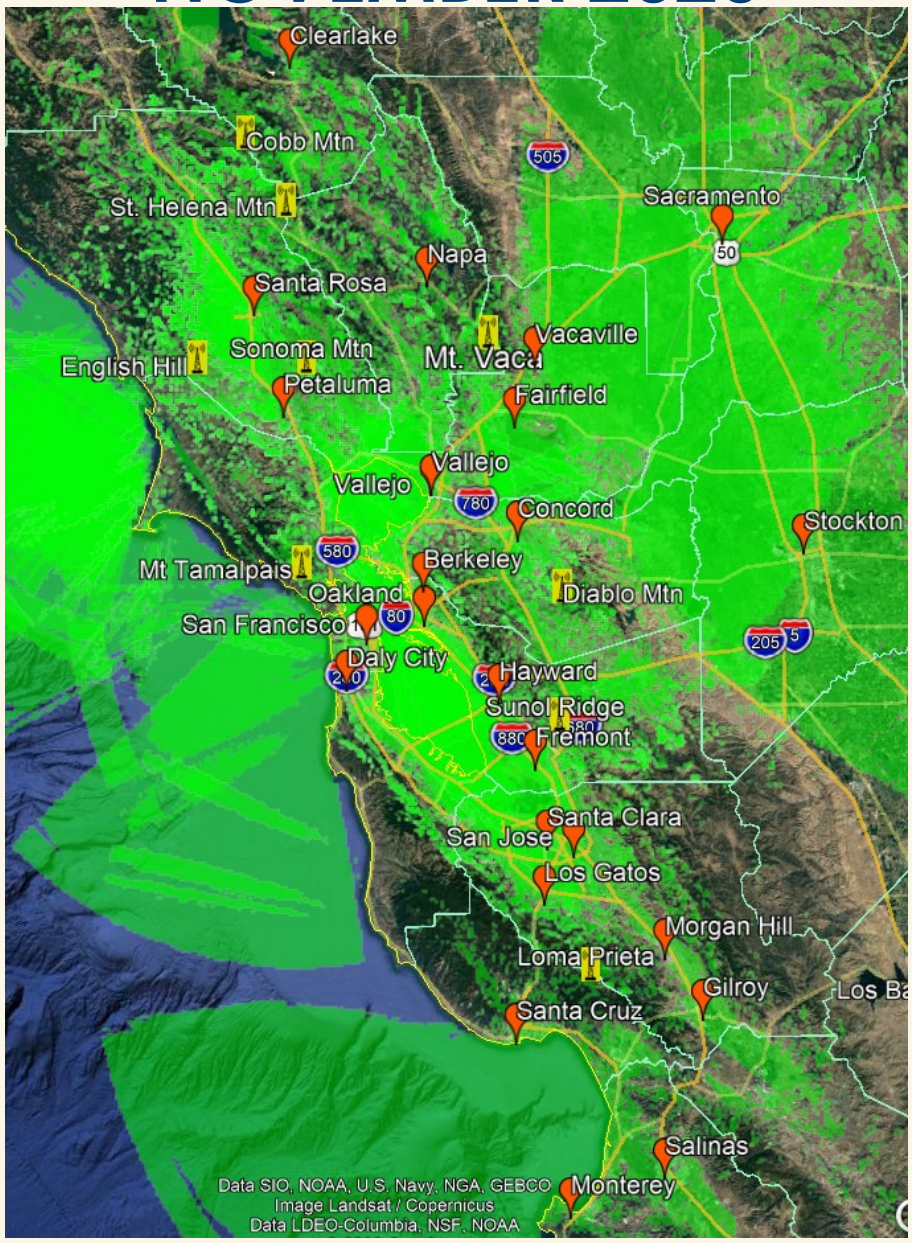
CRIS – EXPECTED BAY AREA COVERAGE NOVEMBER 2020



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RF Site Selection Criteria

Select sites to achieve most coverage and service under budget constraints

Advantage of high elevation sites

Comparing advantage of increasing ERP versus height

Factoring in loading, Most Likely Server (MLS)

Use of Computer studies versus survey

California Terrain

Dense population areas
Mountain Ranges
Large Rural areas
Shielded Canyons

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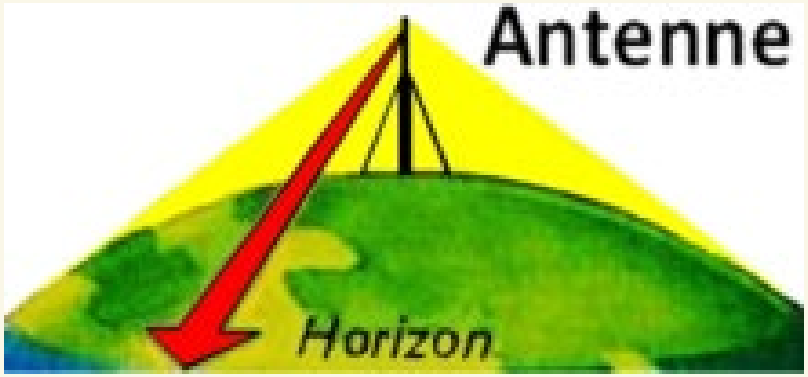
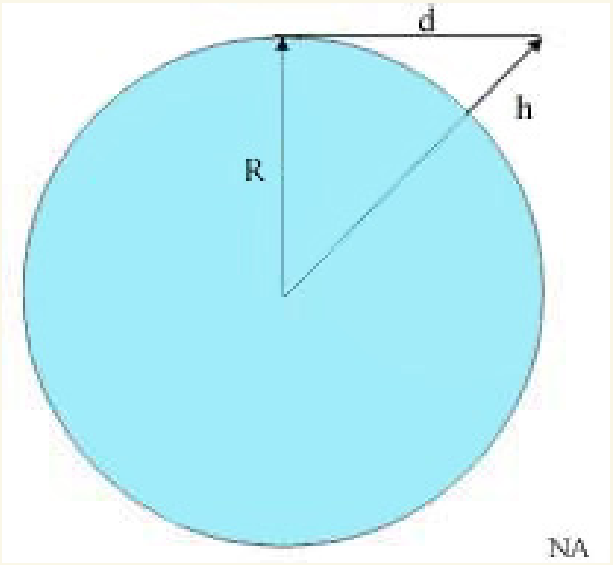
Radio Horizon





(Wikipedia)

Radio horizon (continued)

The geometric distance to the horizon is:

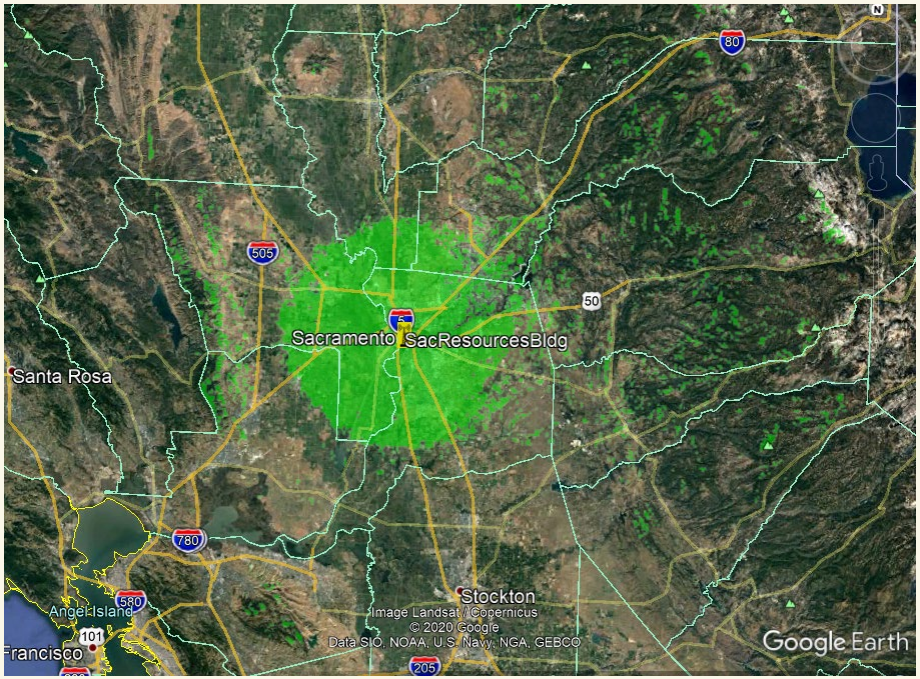
$$d \cong 1.23 \times \sqrt{h(feet)}$$

Antenna Height (HAAT)	Radius of service range (maximum)
100	12 miles
240	19 miles
2000	55 miles
4000	78 miles

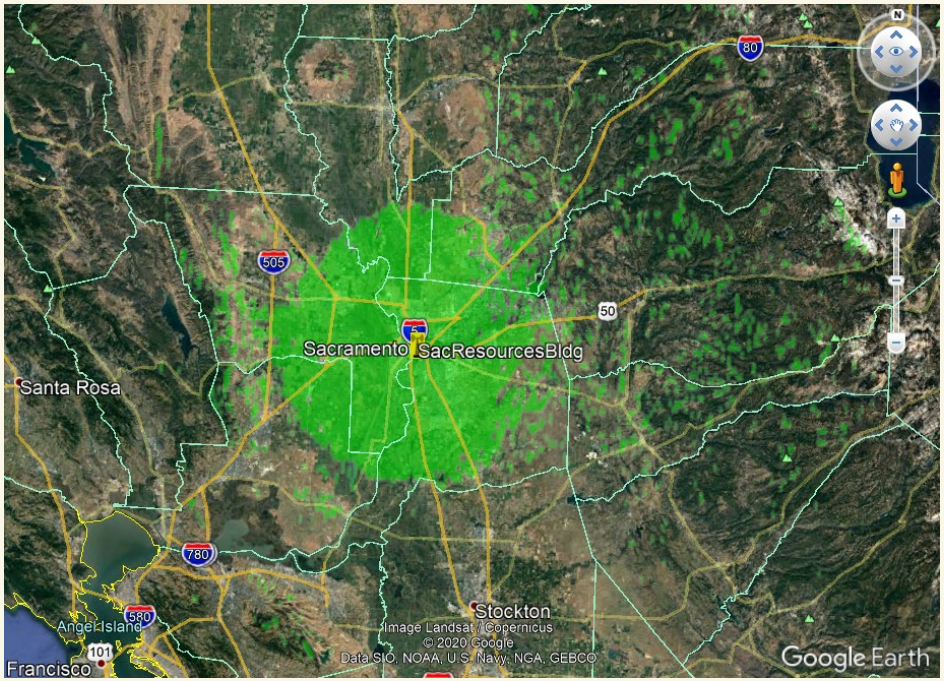
Note: Due to refractive effects, the radio horizon extends by as much as 15%.

DOWNTOWN SACRAMENTO RESOURCES BUILDING CRIS 700 MHZ REPEATER PREDICTED COVERAGE COMPARISON: VARY ERP

RC-AMSL=260', ERP=100W



RC-AMSL=260', ERP=500W



RC-AMSL: RADIATION CENTER ABOVE MEAN SEA LEVEL
ERP: EFFECTIVE RADIATED POWER

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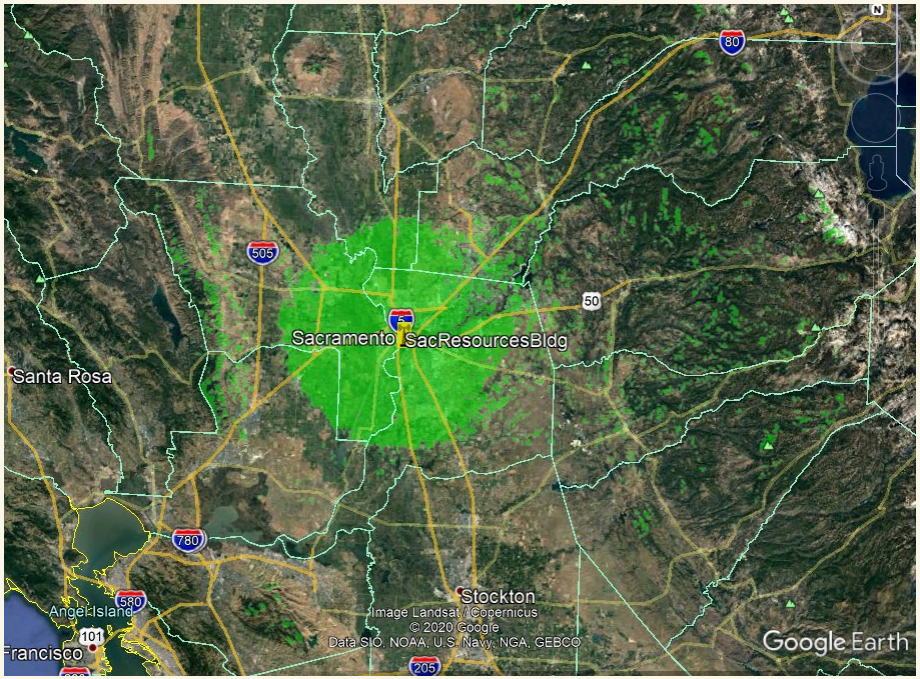
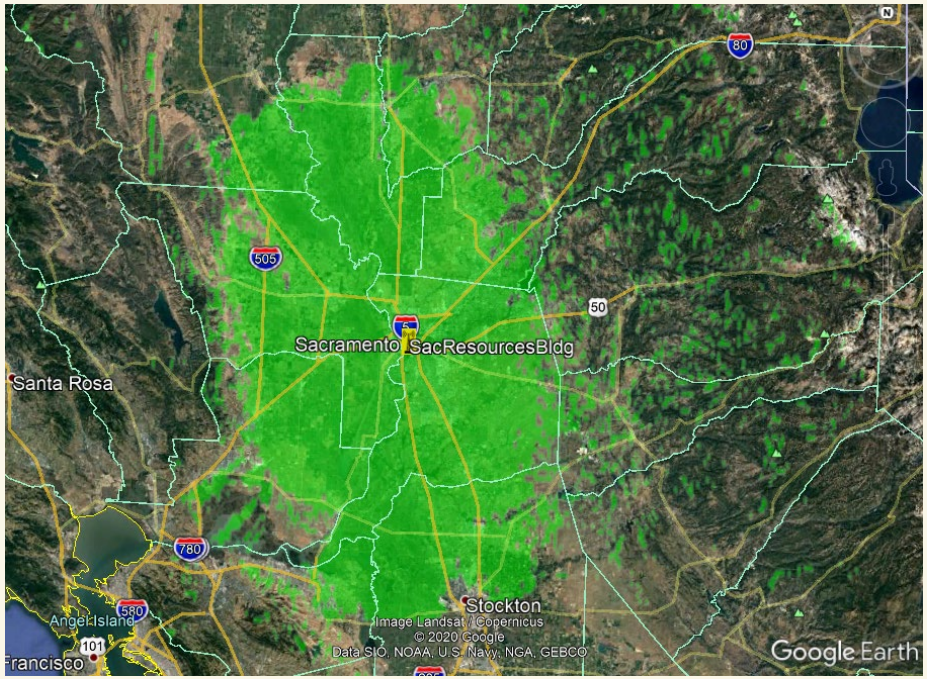
DOWNTOWN SACRAMENTO RESOURCES BUILDING CRIS 700 MHZ REPEATER PREDICTED COVERAGE COMPARISON: VARY HEIGHT

RC-AMSL=260', ERP=100W



RC-AMSL=2000', ERP=100W



RC-AMSL: RADIATION CENTER ABOVE MEAN SEA LEVEL
ERP: EFFECTIVE RADIATED POWER

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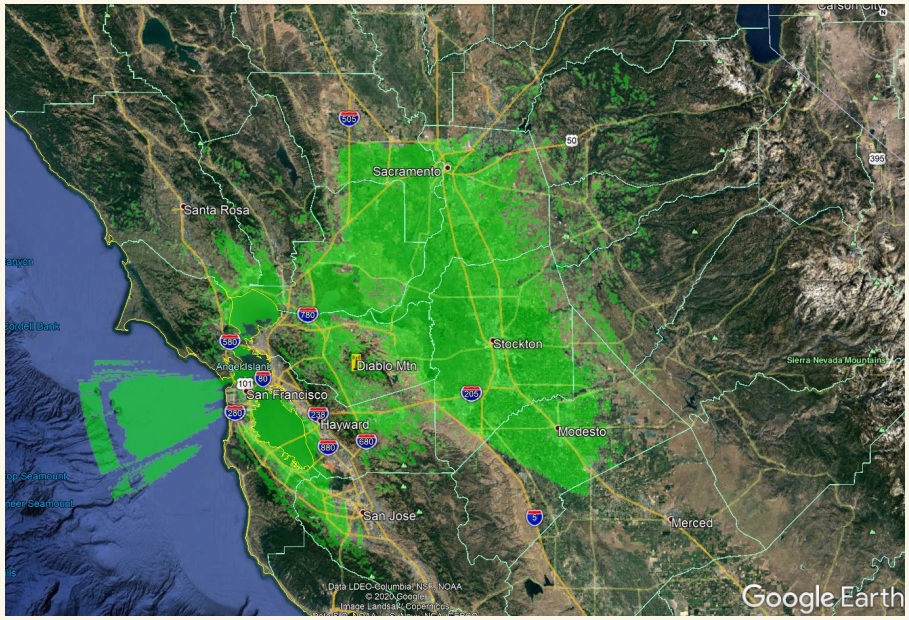
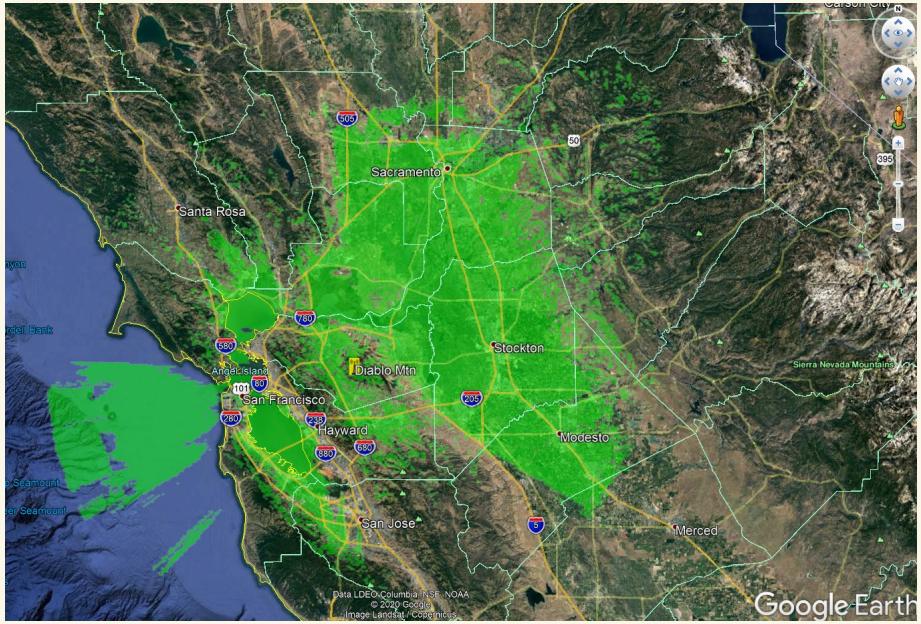
MT. DIABLO CRIS 700 MHZ REPEATER PREDICTED COVERAGE COMPARISON: VARY ERP

RC-AMSL=3866',ERP=100W



RC-AMSL=3866', ERP=500W



RC-AMSL: RADIATION CENTER ABOVE MEAN SEA LEVEL
ERP: EFFECTIVE RADIATED POWER

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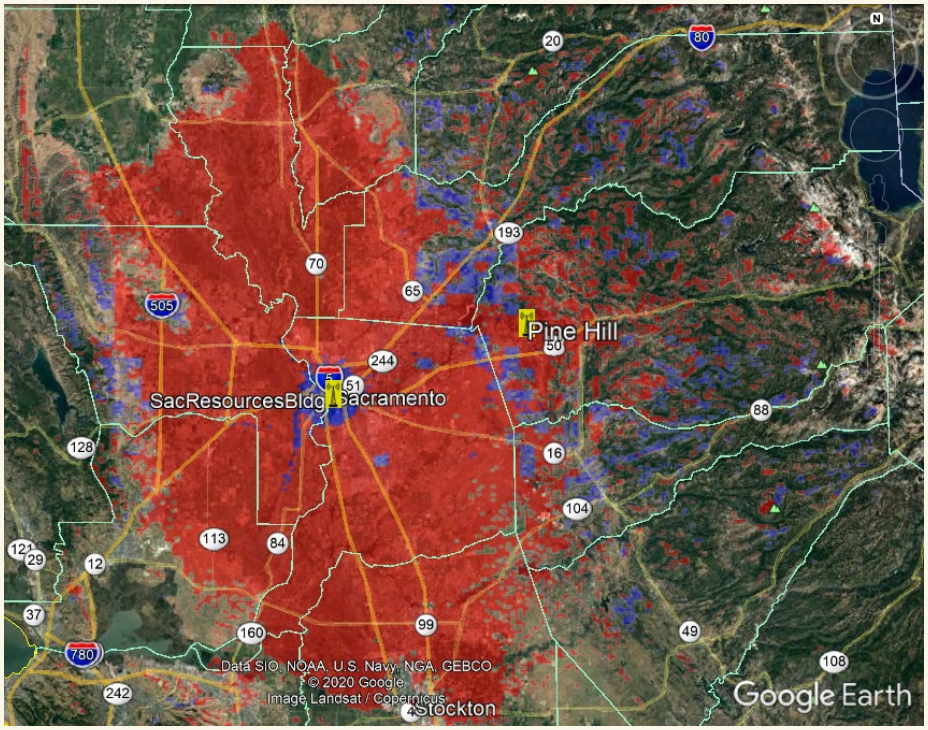
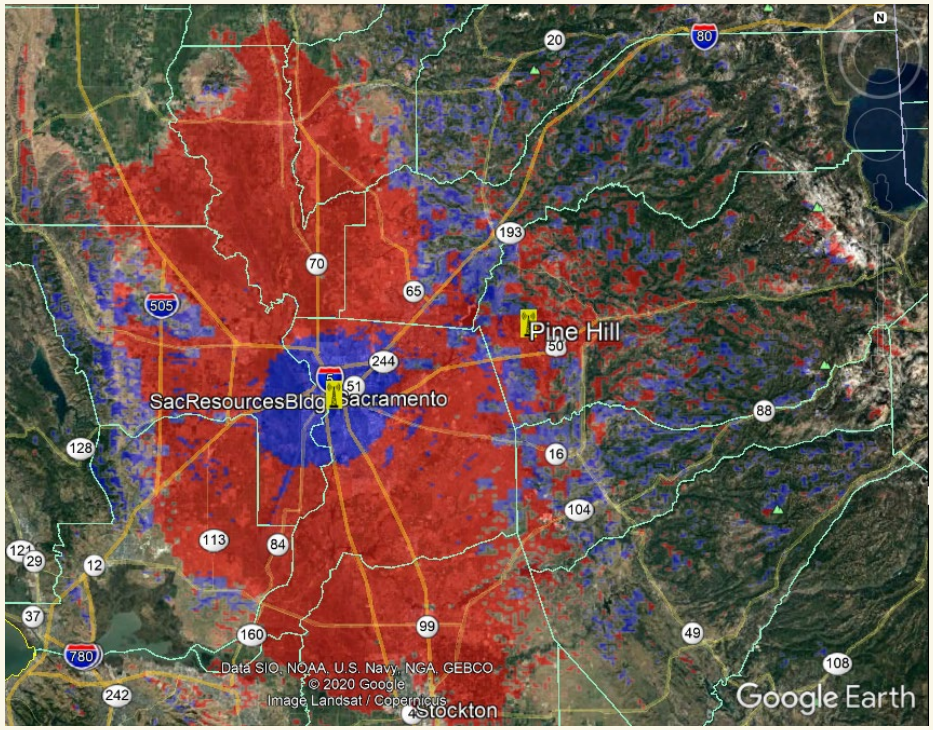
PINE HILL & SACRAMENTO RESOURCES BUILDING CRIS 700 MHZ REPEATERS - MOST LIKELY SERVER

PINE HILL (RED): 100W ERP
DWR (BLUE): 5W ERP



PINE HILL (RED): 100W ERP
DWR (BLUE): 100W ERP



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RF Site Selection Criteria (continued)

Choice of RF modeling criteria

- Choosing dBm level based on BER measurements
- Comparing survey data

Selected Criteria

- Longley-Rice (50/50)
- - 105 dBm

RSSI plot slightly conservative in rural areas, provides significant information on channel re-use and fade margin.

BER (3.0) Illustrates user experience, impacts of noise and multipath.

Central Valley Survey: 3000+ miles, BER & RSSI

future: geo based audio recordings

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Connections between Systems

Traditional channel patches via dispatch consoles

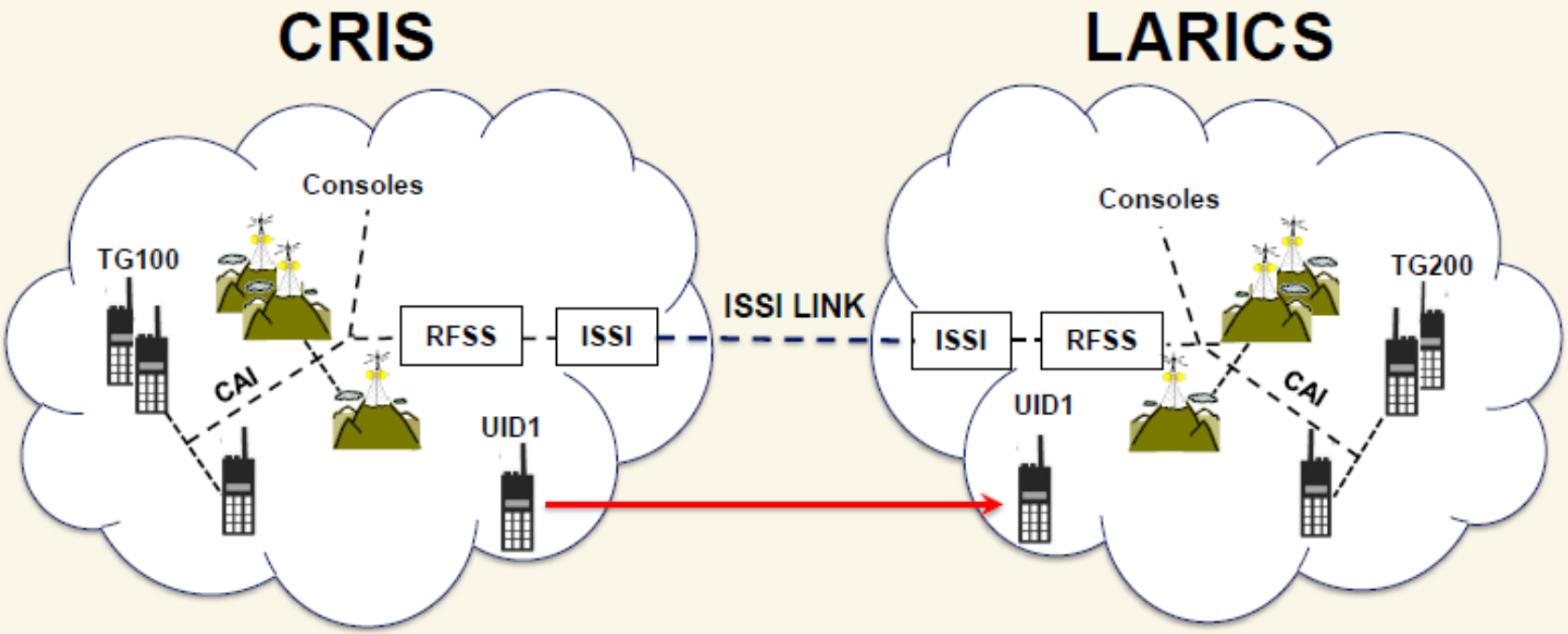
P25 ISSI – Inter RF subsystem interface

- Connects P25 core systems together
- Shares resources
- Must be separate 1-1 connection between each system
- Mapping of channels between multiple connections may be complex, limited to P25 systems
- Expensive

Cloud based server option

Example: Critical Connect

INTER-SYSTEM ROAMING EXAMPLE



UID1 starts on CRIS as the home system and initially communicates only with other CRIS users on TG100. When UID1 leaves CRIS coverage and enters LARICS coverage, the UID1 can initiate a manual mode change so that the user can continue to communicate with CRIS TG100 & consoles and with LARICS TG200 & consoles. This is made possible by creating an iTG Interop talkgroup that maps CRIS TG100 and LARICS TG200 together.

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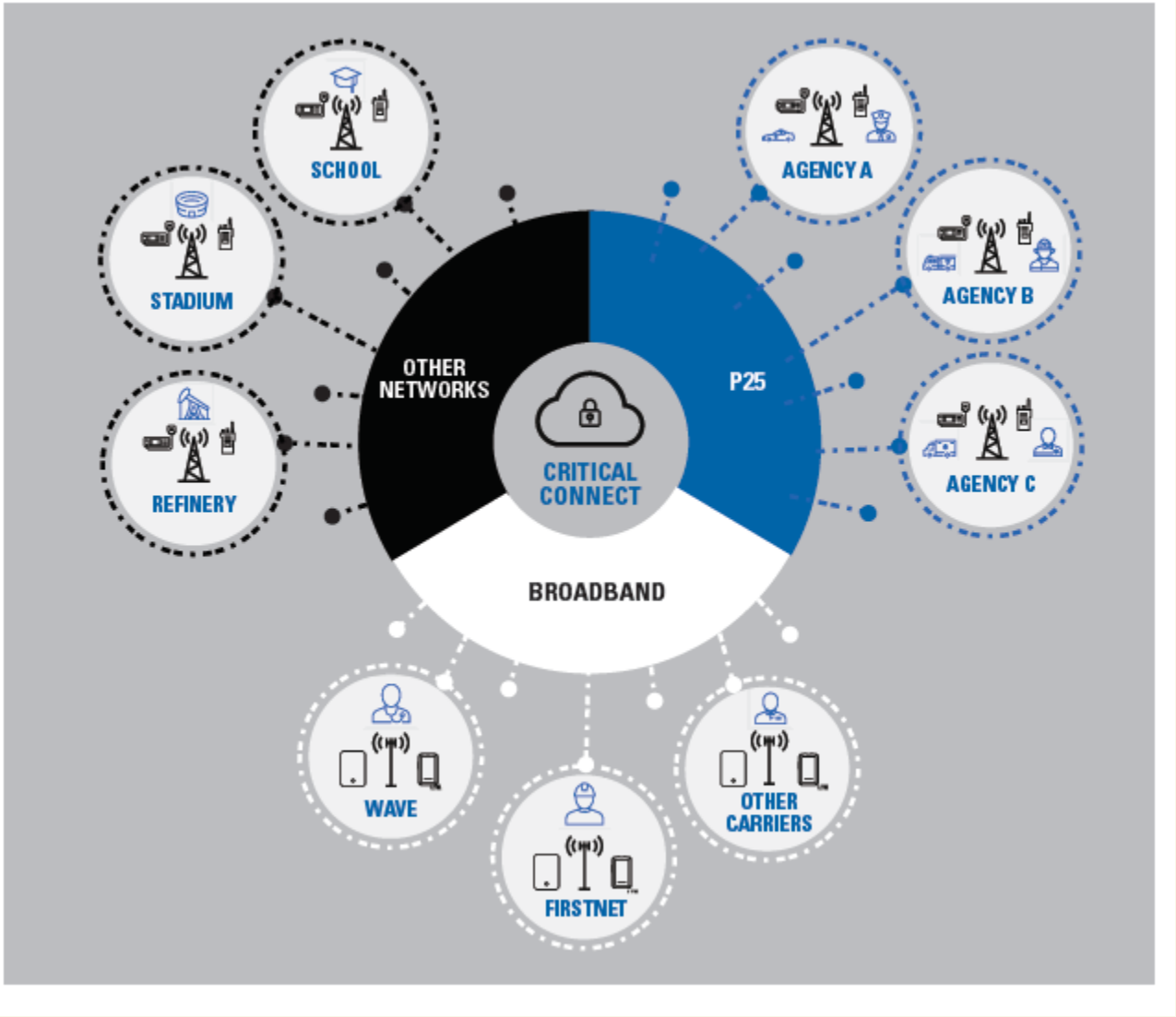
Connections between Systems



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Connections between Systems

MANUAL ROAMING WITH CRITICAL CONNECT

- Visiting radio from CRIS manually changes mode and affiliates on Sac County P25 system as a valid user
- Visiting radio switches to an interop talkgroup and communicates with other radios on CRIS and Sac County P25 networks

AUTOMATIC ROAMING WITH CRITICAL CONNECT

- Visiting CRIS radio registers with their Unit ID on CRIS network (home system)
- Visiting CRIS radio automatically registers on Sac County P25 network (foreign system) with SYS ID + WACN ID + Unit ID
- Control what talkgroups are available on/from foreign systems

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Talk Group Standard Naming Convention

Need P25 community to work together

Interop Talk Groups

How many channels

Naming conventions

Accepted use

CRIS users

Tactical channels

Regional versus statewide

P25 Phase I versus Phase II

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Talk Group Standard Naming Convention

Interop Talk Groups: limit name to 8 characters based on ANSI/NPSTC standard naming convention.

Examples:

- 1 Call TG assigned per “big” agency: e.g. XXXCALL1
- 1 Call TG assigned per county: e.g. YYYCALL1
- 5 State Tactical TGs assigned per “big” agency: e.g. XXXTAC1 thru XXXTAC5
- 5 County Tactical TGs assigned per “big” agency: e.g. YYYTAC1 thru YYYTAC5
- XXX = 3-letter agency code (e.g. CHP, DOT, CDF)
- YYY = 3-letter county code (e.g. SAC, YUB, YOL)

Talk Group Standard Naming Convention

(Continued)

- Primary Talk Groups: limit name to 14 characters based on internally developed naming convention. For example,
  - XXX_CRS_FUNCTN
  - XXX = 3-letter agency code
  - FUNCTN = up to 6-character talk group function code

Questions???

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