COPS Technology Grant Implementation Plan

This is a plan to execute the 2023 US Department of Justice (DoJ) COPS Technology Grant to the Vermont Department of Public Safety (DPS). This plan recommends several changes to the slate of projects included in the original grant request approved in 2023.

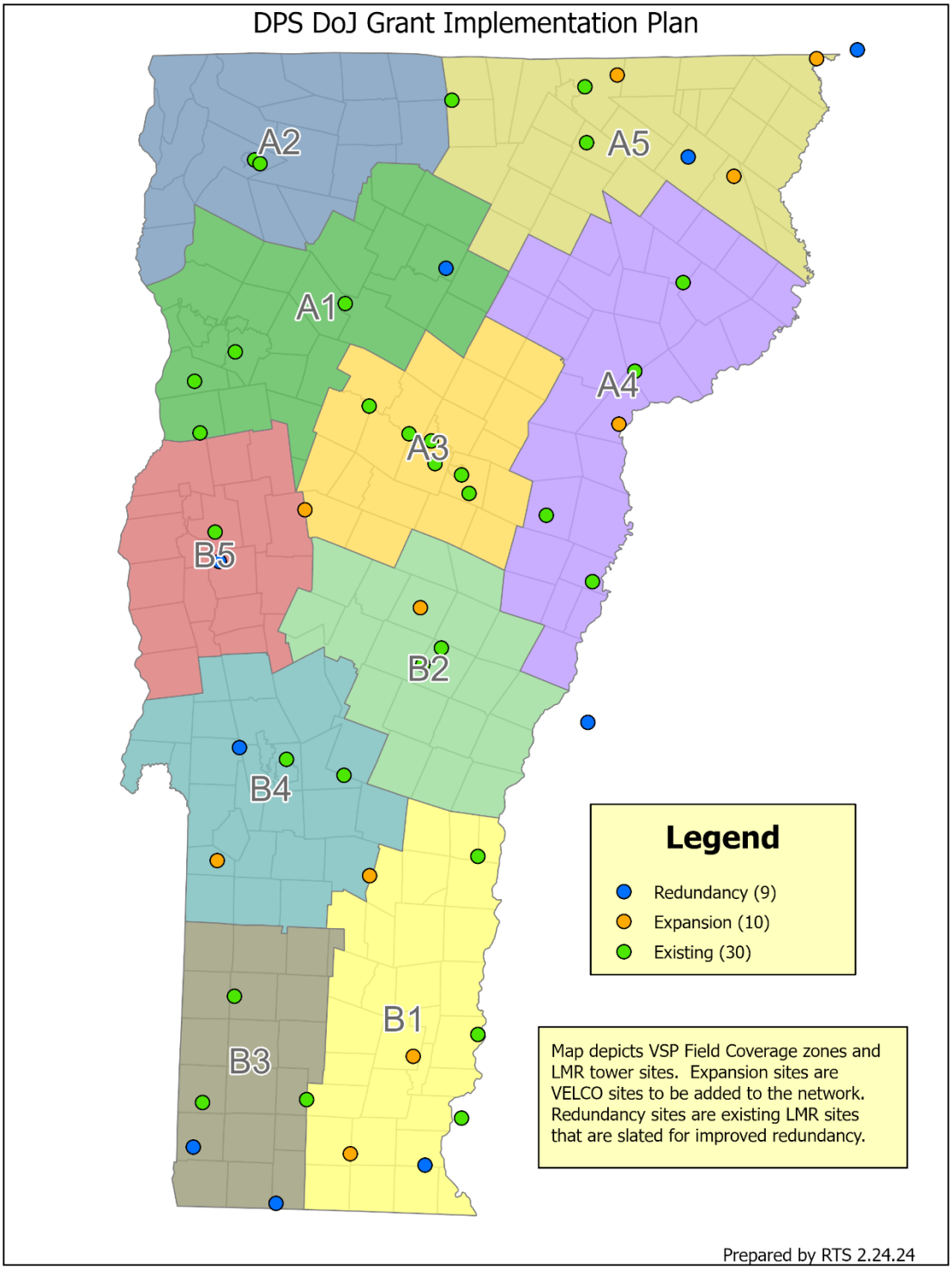
Summary

- RFPs: 21
- ADS Network Security project: 1
- ADS potential independent Reviews: 5
- AG zoning permit petitions at VT PUC: 12

The slate of projects and associated budgets are listed in the table below.

Item	Project	Budget	RPFs
1A	Colocation Site Resilience	$124,161.25	3
1B	Colocation Site Expansion	$426,117.45	0
2	Standby Generators	$240,000.00	1
3	P25 Simulcast Engineering	$621,000.00	1
4	Microwave System Improvements	$675,545.00	3
5	Battery and Rectifier Improvements	$294,462.00	1
6	Test Equipment	$300,000.00	1
7	Antenna Combiner Systems	$354,000.00	1
8	Grounding Improvements	$49,500.00	1
9A	Dispatch improvements Consoles	$576,678.20	1
9B	Dispatch Improvements: Telephone	$171,825.98	1
10A	Statewide P25 Simulcast hardware	$2,858,101.88	1
10B	Statewide P25 Simulcast Antennas	$1,845,800.00	2
11	Network Security	$112,808.24	1
12	Project management	$200,000.00	1
13	Administration	$100,000.00	1
14	Independent Review	$50,000.00	1
	Total	$9,000,000.00	21

The following map illustrates the locations referred to in these projects. It also illustrates the VSP Field Station Coverage areas (also referred to as troop zone areas) referred to in these projects.



Project 1 Part A: Colocation Site Resilience

Budget: $124,161.25, 3 RFPs

This project consists of deployment of a redundant backhaul connection to nine (9) tower sites where RTS presently has only a single connection. Connections to remote tower sites are referred to as backhaul. These sites are all presently served by terrestrial service, supported by fiber optic systems of a service provider. These circuits provide high-quality service, but these are remote locations, prone to outages, and restoration has proven problematic, so diverse backup connections are important. The original proposal called for deployment of high-quality independent microwave circuits from existing RTS sites to these vulnerable sites. Investigation revealed that the original proposed slate of sites is owned by multiple commercial operators. Executing this effort would entail site evaluation work and permitting for each site. This is compounded by the multiple different commercial owners of the sites. For these reasons RTS determined that this effort could not reasonably be achieved in the available timeframe. RTS has developed an alternative proposal to achieve similar results with methodology that we believe can be implemented in the timeframe.

RTS conducted site surveys and determined that these sites have reliable service from mobile wireless providers FirstNet and Verizon. RTS has identified technology that can be used to facilitate connectivity from remote sites to the core RTS MPLS network using backhaul connectivity from mobile wireless providers. This project includes deployment of these services at seven sites. VELCO can provide backup service at one site. Microwave service could be deployed at one site, but this may be eliminated due to time constraints.

Statewide benefits: The project will improve redundancy at 9 existing tower sites in the state LMR network, improving the reliability of these sites. The state LMR network is already used extensively and routinely by all first responders throughout the state, some for primary connectivity and for all as a backup. The improved reliability will benefit all these users immediately, and the improved network would make a more robust starting point for a future statewide network.

Proposed slate of sites with intended redundant backhaul solution:

Town Name	Site name	Type
READSBORO	Readsboro	Cell
HYDE PARK	Hyde Park	Cell
BRIGHTON	Island Pond	Cell
MIDDLEBURY	Chipman Hill	New MW
CASTLETON	Grandpa's Knob	Cell
Clarksville, NH	Ben Young Hill	Cell
Etna, NH	Moose Mt	Cell
BRATTLEBORO	South St	Cell
BENNINGTON	Anthony	VELCO

Work Breakdown

- Cellular backhaul
    a. Independent Review: determine whether IR is required: ADS
    b. Specify equipment: cellular backhaul and network security equipment: RTS
    c. Conduct RFP for equipment: DSP Procurement
    d. Deployment: RTS

- Microwave link: Chipman Hill to Mt Philo (17.6 miles)
    a. Colocation agreement: Chipman Hill tower: DPS legal
    b. Site evaluation work: structural analysis and zoning drawing: RFP
    c. Permits: PUC legal process for two (2) zoning permits: AG
    d. Specify equipment: RTS
    e. Conduct RFP for equipment: DPS procurement
    f. Deployment: install microwave antennas (expert from RFP for project 4)

Project 1 Part B: Colocation Site Expansion

Budget: $426,117.45, 0 RFPs

This project consists of expansion of the network by adding new tower sites. These sites would be connected with microwave backhaul links to existing RTS sites. The original proposal was to deploy service at sites where VELCO was determined to have service. VELCO is the Vermont Electric Company, which manages all electric transmission lines in Vermont. To maintain this system VELCO maintains the largest LMR system in Vermont. Investigation revealed that the original proposed slate of sites is owned by multiple commercial operators. Executing this effort would entail site evaluation, permitting, and contract negotiation for each site. For these reasons RTS determined that this effort could not reasonably be achieved in the available timeframe. RTS has developed an alternative proposal to achieve similar results with methodology that we believe can be implemented in the timeframe.

Work by RTS and VELCO engineers identified a new slate of 10 sites for expansion. Eight are owned by VELCO; VELCO is able to facilitate access for the other two. VELCO will provide the necessary site evaluation work as part of the colocation agreement. This work with a single entity significantly eases implementation requirements. VELCO will provide primary and backup electrical power at all sites. VELCO is willing to offer backhaul connectivity for all sites on its existing network, but only as a backup: RTS must maintain an independent primary link. Investigation has determined a proposal for backhaul connectivity at each site: three sites can be served by microwave connectivity, one with terrestrial fiber, and six with service from mobile wireless providers FirstNet or Verizon. The mobile wireless service will be implemented using the same technology as will be deployed for

Statewide benefits: The project will expand the footprint of the state LMR network. The state LMR network is already used extensively and routinely by all first responders throughout the state, some for primary connectivity and for all as a backup. The improved reliability will benefit all these users immediately, and the improved network would make a more robust starting point for a future statewide network.

Proposed slate of expansion sites

Town name	Site name	Owner	Channels	Backhaul
TOWNSHEND	Crane Mt	VELCO	1	MW Equinox (existing)
LINCOLN	Lincoln	Consortium	4	Eline (WCVT)
FERDINAND	Wenlock	VELCO	1	Cell
WILMINGTON	Mt Olga	Nat Grid	2	Cell
WELLS	NE Mt	VELCO	1	New MW Equinox 18.3M
CANAAN	Green Hill	VELCO	1	Cell
MOUNT HOLLY	Okemo	VELCO	3	Cell
BARNET	Barnet	VELCO	1	Cell
RANDOLPH	Randolph	VELCO	1	Cell
DERBY	Nelson Hill	VELCO	1	New MW to Derby 4.6M

Work Breakdown

- Colocation agreement: VELCO, review by DPS legal
    - Agreement will include network backhaul and site evaluation work
- Site evaluation work: VELCO
- Permits: legal process for ten (10) zoning permits: AG
- Equipment
    - Cellular backhaul: included in project 1A
    - New microwave equipment: (Nelson Hill and NE Mt) included in project 1A
    - LMR radios and antennas: included in project 10
    - Battery/power systems: included in project 5
    - SAR Routers: included in project 4
    - Antenna installation: expert from RFP in project 4

Project 2: Standby Generators

Budget: $240,000, 1 RFP

This project calls for deployment of generators at nine sites, including delivery and installation.

Statewide benefits: This project will improve reliability at remote sites by improving operations when commercial power is disrupted by replacing aging generators. This reliability will extend to regional efforts if they use these sites.

Slate of new generator sites

Site	Type
RTS Shop	Propane
BROWNINGTON	Propane
KILLINGTON Mt.	Propane
- engineering to change location	
Spare	Propane
MT. MANSFIELD	Diesel
- helicopter to deliver	
MT. SNOW	Propane
PIERSON HILL	Propane
RUSS HILL	Propane
STREETER HILL	Propane

Work Breakdown

- Colocation: determine if generators are allowed by existing agreements: RTS
- Specify equipment: RTS
- Conduct RFP: DPS procurement
- Deployment: included in RFP

Project 3: P25 ENGINEERING AND DESIGN SERVICE

Budget: $621,000, 1 RFP

This project originally called for engineering and analysis to determine requirements to deploy P25 digital service within each of the 10 VSP Field Station Coverage zone.

VSP Field Station	Troop Zone
Willison/PSAP	A1
St. Albans	A2
Middlesex	A3
St. Johnsbury	A4
Derby	A5
Westminster/PSAP	B1
Royalton	B2
Shaftsbury	B3
Rutland	B4
New Haven	B5

The scope of this project will be expanded to include determination of requirements for simulcast digital P25 operation in UHF LMR service for each of the VSP troop zones. This engineering and design service will consider the existing and proposed tower sites and the territory of each troop zone to determine requirements for proper operation. This will include three deliverables, deployed in two phases.

- Phase 1, Propagation analysis to determine optimal digital P25 simulcast parameters.
- Phase 1, Recommendation for antenna and combiner specifications to be deployed at all sites.
- Phase 2, Simulcast optimization configuration assistance including identification of proper timing and signal levels for all sites. These services will be provided after completion of Project 10.

Statewide Benefits: This project will improve coverage, clarity, and support encryption for VSP channels by moving to digital P25. The channels are used by many agencies statewide, and these improvements will accrue to these users as well. Through this effort, DPS and its engineers and technicians will gain experience deploying and operating a simulcast network, and this experience will ease the pathway for other agencies that also plan to move to digital simulcast. The results will also provide an engineering baseline for possible future deployments on the basis of these zones.

Work Breakdown

- Define scope of work: RTS
- Conduct RFP: DPS procurement
- Deployment: retained expert

Project 4: MICROWAVE ANTENNA SYSTEMS UPGRADE AND IMPROVEMENTS

Budget: $675,545, 3 RFPs

This project calls for replacement of 27 existing microwave antennas. The current microwave antennas deployed throughout the network are susceptible to ice build-up. New high-performance antennas provide better performance and are less susceptible to ice build-up, which improves reliability. The project also includes a hardware upgrade of the 58 Nokia SAR routers, necessary to allow future software updates.

Slate of sites:

RTS Microwave Site	Qty
Burke Mountain	3
Jay Peak	3
Killington Mountain	2
Millstone	2
Mt. Ascutney	2
Mt. Equinox	2
Mt. Mansfield	3
Mt. Philo	2
Mt. Snow	2
Pierson Hill	1
Russ Hill	2
Streeter Hill	1
Bellevue Hill	2
Total	27

Statewide Benefits: This project will improve reliability at remote sites. This reliability will extend to regional efforts if they use these sites.

Work Breakdown

Microwave antennas and router upgrades

- Define scope of work: RTS
- Independent Review: determine whether IR is required: ADS
- Conduct two RFPs: DPS procurement
- Deployment: RTS

Microwave antenna installation

- Define scope of work: RTS
- Conduct RFP: DPS procurement
- Deployment: expert

Project 5: BATTERY AND RECTIFIER SYSTEMS IMPROVEMENTS

Budget: $294,462, 1 RFP

This project includes Rectifiers and Batteries. It originally called for deployment of new batteries at 29 existing RTS sites. This project will be expanded to include the 10 VELCO expansion sites.

Existing RTS sites			VELCO sites
ASCUTNEY	JAY PEAK	READSBORO	Crane Mt
BELLVUE	KILLINGTON MT.	ROYALTON	Lincoln
BEN YOUNG HILL	MILLSTONE HILL	RUSS HILL	Wenlock
BROWINGTON CENTER	MT. ANTHONY	RUTLAND VSP	Mt Olga
BURKE MT.	MT. MANSFIELD	ST. ALBANS	NE Mt
CHIPMAN HILL	MT. PHILO	ST. JOHNSBURY	Green Hill
DERBY	MT. SNOW	STATE STREET	Okemo
EQUINOX	NELSON HILL	STREETER HILL	Barnet
GRANDPAS KNOB	NEW HAVEN BARRICKS	WILLISTON BARRACKS	Randolph
H.Q. (WATERBURY)	PIERSON HILL		Nelson Hill

Statewide Benefits: This project will improve reliability at remote sites. This reliability will extend to regional efforts if they use these sites.

Work Breakdown

- Define equipment specifications: RTS
- Conduct RFP: DPS procurement
- Deployment: RTS

Project 6: TEST EQUIPMENT

Budget: $300,000, 1 RFP

This project includes portable service monitors with Vendor Network Analyzer (VNA). These are radio test instruments that include comprehensive digital and analog Land Mobile Radio (LMR) testing and the ability to measure important RF network characteristics to measure Distance to Fault (DTF), Return Loss, and Voltage Standing Wave Ratio (VSWR) with the ability to display advanced RF parameters in a Smith Chart for more complicated network analysis. This project calls for 10 such devices such as the Freedom R8200.

Statewide Benefits: This project will improve the ability of RTS technicians to maintain the state LMR network. Many regional agencies presently use the state LMR channels, so improved performance will benefit them. Improved RTS capability will also assist regional networks to the extent that RTS staff maintain their networks.

Work Breakdown

- Define equipment specifications: RTS
- Conduct RFP: DPS procurement
- Deployment: RTS

Project 7: ANTENNA COMBINER SYSTEMS

Budget: $354,000, 1 RFP

This project includes 22 RF combiners for the UHF antenna path. Combiners are required to enable multiple radios to transmit and receive using a single antenna mounted high on a tower. This reduces the quantity of antennas that must be located on a tower. Antennas can fail during harsh weather, and making effective use of them improves reliability. The move to simulcast increases the quantity of radios at each site, which increases the benefits of deploying combiners. Specifications for these combiners will be produced through the P25 engineering work, project 3.

Channels	Qty
2	16
3	4
4	2
Total	22

Statewide benefits: Combiners allow multiple channels to utilize a single antenna installed on a tower. This project will make it easier for regional users to collocate at existing state sites as they can utilize more of the existing facilities.

Work Breakdown

- Define equipment specifications: RTS
- Conduct RFP: DPS procurement
- Deployment: RTS

Project 8: GROUND SYSTEM IMPROVEMENTS

Budget: $49,500, 1 RFP

This project involves services to analyze the site, determine necessary improvements, and implement these improvements at nine sites. RTS may determine to expand this project to include additional sites.

BELLEVUE HILL
BROWNINGTON
KILLINGTON Mt.
MILLSTONE HILL
MT. MANSFIELD
MT. SNOW
PIERSON HILL
RUSS HILL
STREETER HILL

Statewide benefits: Proper grounding improves reliability and clarity of the signals and reduced interference when there are multiple operators with multiple channels at a single site. This project will improve the ability of the existing sites to support deployment of additional channels should regional agencies seek to deploy service at these sites.

Work Breakdown

- Define equipment specifications: RTS
- Conduct RFP: DPS procurement
- Deployment: retained expert

Project 9 Part A: Dispatch improvement: Consoles

Budget: $576,678.20, 1 RFP

This project includes the upgrade of the existing dispatch system in the VSP PSAPs in Westminster and Williston to incorporate telephone service within the LMR dispatch console and offers several advantages. It eliminates an aging analog telephone system and a convoluted problem-inducing system that presently combines the two systems. Importantly, it significantly simplifies the dispatch infrastructure in a single platform, which makes it possible to deploy dispatch seats in new locations easily. This could be used to move existing PSAPs and/or stand up additional PSAPs, permanently or temporarily, for VSP or even for other agencies.

This part of the project upgrades the existing dispatch consoles. The project could be accomplished with an update to the Windows application from the current vendor. It requires new digital audio peripherals. It may also include replacement PCs and monitors. The consoles interface with an existing back-office dispatch audio system; vendors may also bid to replace this. The new consoles must include an integrated VoIP telephone client. This project must include coordination of deployment of VoIP telephone service in the VSP PSAPs.

Statewide Benefits: This project will upgrade the existing dispatch consoles at the VSP PSAPs. DPS dispatches for many areas and functions, and the improved consoles will increase performance for these functions. The upgrade will also require a transition to voice over IP, which will facilitate changes to the aging DPS telephone systems.

Work Breakdown

- Independent Review: determine whether IR is required: ADS
- Define equipment specifications: RTS
- Conduct RFP: DPS Procurement
- Deployment:
    - Physical installation: RTS
    - Configuration support: retained vendor

Project 9 Part B: Dispatch improvement: Telephone System

Budget: $171,825.98, 1 RFP

This project includes the upgrade of the existing dispatch system in the VSP PSAPs in Westminster and Williston to incorporate telephone service within the LMR dispatch console and offers several advantages. It eliminates an aging analog telephone system and a convoluted problem-inducing system that presently combines the two systems. Importantly, it significantly simplifies the dispatch infrastructure in a single platform, which makes it possible to deploy dispatch seats in new locations easily. This could be used to move existing PSAPs and/or stand up additional PSAPs, permanently or temporarily, for VSP or even for other agencies.

This part of the project includes deployment of VoIP call managers (essentially the modern equivalent of a telephone switch) on-site at each of the two VSP PSAPs. The dispatch consoles at each PSAP will be connected to the call manager at the local PSAP as well as to the other PSAP through a connection on the RTS network. This heightened level of redundancy will ensure that the dispatch consoles can remain operational even during outages of the ADS data network.

Statewide Benefits: This project will upgrade the existing dispatch consoles at the VSP PSAPs. DPS dispatches for many areas and functions, and the improved consoles will increase performance for these functions. The upgrade will also require a transition to voice over IP, which will facilitate changes to the aging DPS telephone systems.

Work Breakdown

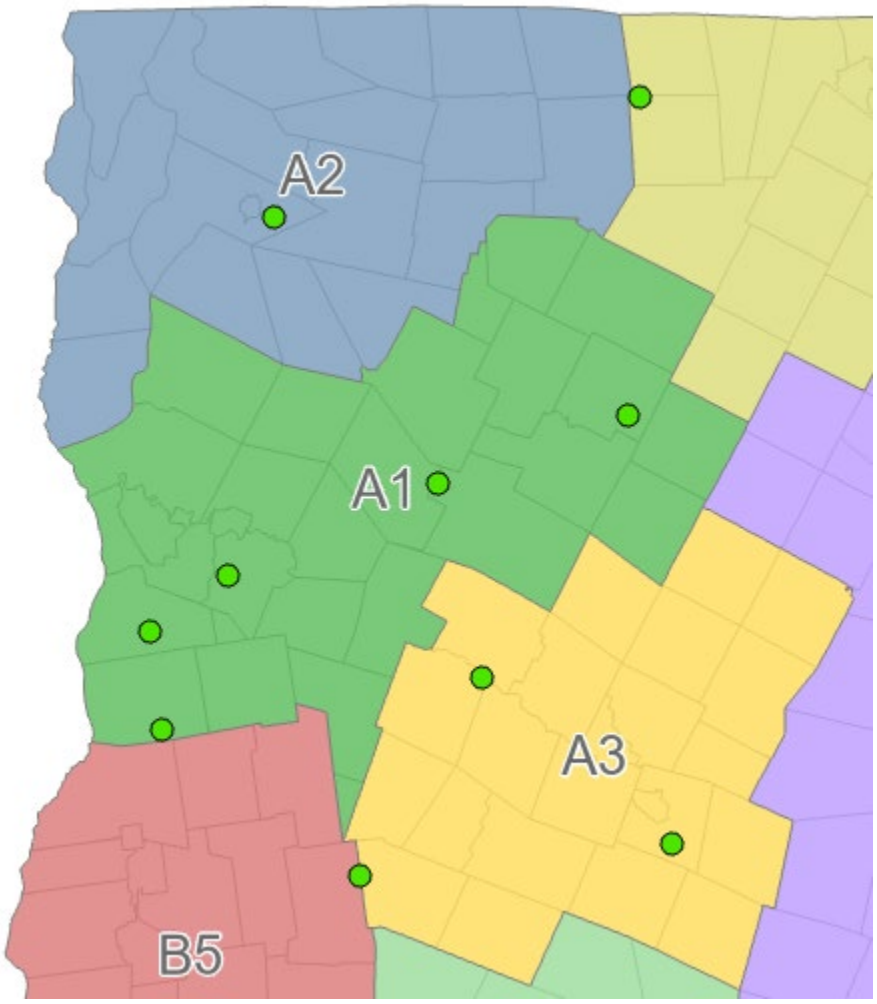
- Independent Review: determine whether IR is required: ADS
- Define equipment specifications: RTS
- Conduct RFP: DPS Procurement
- Deployment:
    - Physical installation: RTS
    - Configuration support: retained vendor

Project 10 Part A: Digital P25 Simulcast Upgrade

Budget: $2,858,101.88, 1 RFP

This proposed project replaces the original project in the grant proposal. It would upgrade the existing VSP UHF LMR network. That network is currently operated as an analog multicast network. This upgrade would enable digital P25 simulcast service.

In a large network, multiple tower sites are required to provide coverage throughout an area. In a multicast topology, typically one mountain top site transmits, and there are multiple receive-only sites; the user selects which to transmit on. In a simulcast topology, all sites are duplex (transmit and receive), and the network determines which site is best for each user, like a cell network. The current VSP network includes 26 duplex systems spread over all VSP zones. In many cases, a single tower will serve multiple VSP zones. The simulcast upgrade will require 46 new duplex radio systems. The project will also involve additional hardware including timing systems at each site and comparators for each zone, to be installed at the VSP PSAPs. The clip below illustrates that there are five tower locations with the territory of troop zone A1. To achieve optimal coverage, five additional tower sites outside the territory will also be equipped to support this channel.



This project involves the procurement of all the required networking equipment. This project will be initiated at the same time as Project 3 (P25 simulcast engineering). That project will provide the engineering information necessary to configure the equipment procured in this effort. The table below depicts the quantity of channels existing and to be added in each zone.

	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	Total
Existing	2	1	3	3	3	3	3	4	2	2	26
New	8	3	6	5	6	6	4	3	3	2	46
Total	10	4	9	8	9	9	7	7	5	4	72

Statewide benefit: This will improve coverage, clarity, and encryption for VSP channels by moving to digital P25. Simulcast will also improve officer safety by simplifying operation. The channels are used by many agencies statewide and these enhancements will accrue to these users as well. Simulcast is a stepping stone on the migration to a trunked network; many of the improvements will enable the sites to support simulcast for other channels as well. The improvement to digital simulcast is a step on the transition to a trunked system that will likely eventually be deployed.

Work Breakdown

Phase 1: Simulcast equipment

- Define equipment specifications: RTS
- Independent Review: determine whether IR is required: ADS
- Conduct RFP: DPS procurement
- Physical Deployment: RTS

Project 10 Part B: Antennas

Budget: $1,845,800, 2 RFP

Proper operation of a P25 digital simulcast network requires that antennas at each site be specifically designed to deliver the required coverage. Most sites in the network will transmit only on a single channel serving the zone in which they are located. In many sites, though, the site will transmit on the channels for the neighboring zones as well, which will necessitate multiple specialized antennas. Table 1 depicts the quantity of sites with various channels. Table 2 depicts the quantity of required antennas. This project cannot be completed until the specifications for the required antennas are completed, a deliverable from project 3.

Table 1	
Sites	Channels
32	1
11	2
4	3
2	4

Table 2		
Sites	Antennas	Total
32	2	64
15	4	60
2	6	12
49		136

Phase 2: Antennas

- Define equipment specifications: Results of Project 3
- Conduct RFP for equipment: DPS procurement
- Conduct RFP for installation: DPS procurement

Project 11: Network Security

Budget: $112,808.24, 1 RFP

Projects 1 and 9 both require integration of the RTS MPLS network with other data networks. ADS maintains a separate network that reaches most police departments throughout the state. The ADS network and RTS network are currently not interconnected; the RTS MLPS network is operated as a private network. With proper security management, these networks could be integrated, which would allow these sites to access resources on the RTS network. This will include provisions for rigorous cyber security protection. Security should be designed with these future use cases in mind.

- Network Security
    (1) Determine network security requirements: ADS
    (2) Acquire and deploy network security (firewalls): ADS

Statewide Benefits: The RTS MPLS network is a powerful asset that could be leveraged to support other agencies. For instance, other agencies could deploy compatible dispatch consoles and connect to the RTS end-office dispatch network to access the radio network.

Project 12: Project Management

Budget: $200,000, 1 RFP

Administrative support to oversee execution of all projects.

Work Breakdown

- Define scope of work: RTS
- Conduct RFP: ADS
- Execution

Vendor has been selected, the contract has been drafted and completed PAT review and is currently routed for signatures.

Project 13: Administration

Budget: $100,000, 1 RFP

In addition to the project manager, the initial proposal included support for a temporary state employee to assist with project fulfillment. This project would provide administrative support to execute the project as a Limited Service Position to support this project. Recent experience at DPS demonstrates that it is difficult to retain expertise in this manner that could assist with this project given the temporary nature of the project. DPS believes that this administrative support is necessary to successfully execute the grant projects contractual arrangement and seeks to arrange for these services through a contractual arrangement.

Project 14: Independent review

Budget: $50,000, potentially several RFPs

Individual projects may require independent review pursuant to Vermont Statutes. ADS may, at its discretion, require IRs for specific individual projects if it deems that they are IT-related. Individual projects that may require IR are identified above.

RTS sought Strategic Planning Assistance, seeking advice about the proposed method of executing the grant funding. The purpose of this review is to have an outside perspective review the plan for spending the $9M CDS grant against both the requirements/restrictions of the COPS TECH funding stream and the content and intent of relevant language in Act 78 [2023]. It is DPS' intention to utilize the grant funding in a manner that provides the most value and benefits the broadest user base possible. To implement this effort, ADS conducted an RFP through the Independent Review retainer pool, but no bids were received. RTS conducted a simplified bid to five qualified vendors, and one bid was received, but it was withdrawn. RTS continues the simplified bid effort with solicitation to other vendors.