State Auditor
Dave Boliek
RAPID RESPONSE SPECIAL REPORT

North Carolina
Office of the State Auditor
Rapid Response Division
1-800-730-TIPS

November 16, 2026

Voice Interoperability Plan for Emergency Responders (VIPER)

WHY WE CONDUCTED THIS REPORT

In the aftermath of Hurricane Helene, the Office of the State Auditor (OSA) has consistently monitored areas of concern related to the State of North Carolina's disaster preparedness efforts and response to the storm. As a part of this ongoing effort, OSA initiated a review of communications disruptions to the Voice Interoperability Plan for Emergency Responders (VIPER) mobile radio system, which occurred both during and after the storm.

OBJECTIVE

To understand why VIPER experienced communication disruptions during Hurricane Helene, and to identify any needed improvements.

WHAT WE FOUND

- 12 VIPER sites were damaged during Hurricane Helene, which led to **increased downtime and unreturned calls**.
- A report published by a third party identified several technical failings in the VIPER system, including insufficient integration with satellite-based communication alternatives and delays of over an hour when attempting to share or request information.
- The North Carolina State Highway Patrol (NCSHP) has requested from the North Carolina General Assembly dollars for increased operations and maintenance funding for VIPER, which NCSHP submits is necessary to sustain system readiness and address outages in a timely manner.

BACKGROUND

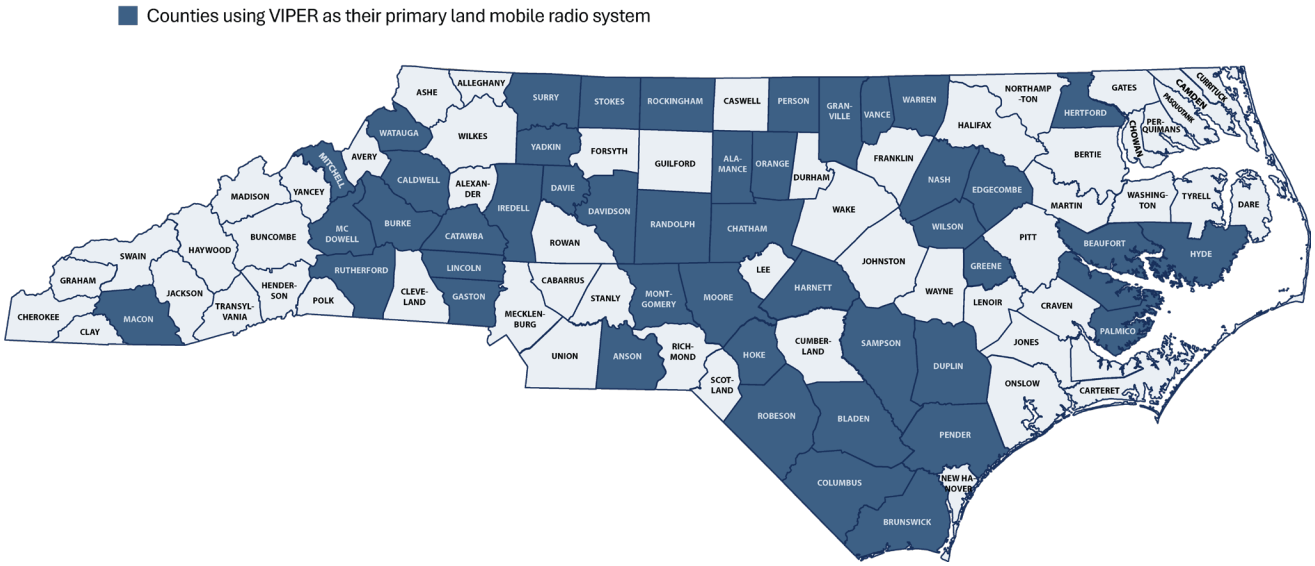
VIPER is a statewide radio system managed and administered by NCSHP.[1] VIPER's purpose is to connect public safety agencies through a single common radio system accessible to all federal, State, and local disaster response agencies operating across North Carolina.[2] Although public safety agencies are not required by law to use VIPER, the system is recognized as the "statewide

[1] North Carolina Strategic Communication Interoperability Plan - January 2025, pg. 8.
[2] Ibid., pg. 10.

platform for interoperable radio communications."[3] Public safety agencies use VIPER to dispatch emergency responders and effectively coordinate interagency disaster response efforts.[4]

According to the North Carolina Strategic Communication Interoperability Plan (SCIP) published by the Statewide Interoperability Executive Committee (SIEC) in January 2025,[5] the VIPER "network consists of 240 towers, over 198,000 subscriber IDs, and more than 350 agencies relying on VIPER daily."[6] Plans are in the works to increase the maximum capacity of user IDs to 300,000. As reported by NCSHP, 90.8% of the state is within VIPER's coverage area.[7] Despite the large coverage area, however, NCSHP reported that only 45 of North Carolina's 100 counties use VIPER as their primary land mobile radio system for emergency response. NCSHP also informed OSA that while other counties use VIPER, those counties do not use it as their primary radio system.

FIGURE 1: Use of VIPER as Primary Land Mobile Radio System, by County



When an emergency arises, responders from various public safety agencies and counties communicate through the VIPER network via shared "talkgroups" which enable coordination between disaster response teams.[8]

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[3] VIPER Statewide Template Operating Requirements and Usage Guidelines - April 2024, at pg. 3.
[4] Ibid.
[5] Designed as a subcommittee of the State Emergency Response Commission, the SIEC is "tasked with developing the SCIP and offering expertise on interoperable communications." North Carolina Strategic Communication Interoperability Plan - January 2025, pg. 10. SIEC works with the NCSHP's Technical Services Unit and local Land Mobile Radio administrators to support the VIPER network. Ibid.; *see also* VIPER Statewide Template Operating Requirements and Usage Guidelines - April 2024, at pg. 3.
[6] North Carolina Strategic Communication Interoperability Plan - January 2025, pg. 10.
[7] By region, VIPER covers 97.5% of the state that lies east of US 321 and 71.5% of the state west of US 321.
[8] *See, e.g.*, VIPER Statewide Template and Operating Requirements and Usage Guidelines - April 2024, pg. 4.

In the event of an emergency, SIEC recommends that public safety agencies that rely on VIPER's talkgroups utilize the Primary, Alternate, Contingency, and Emergency planning system (the PACE system).[9] Should the Primary VIPER talkgroup become unavailable, teams can switch to an Alternate (another VIPER talkgroup or regional channel), Contingency (satellite or mobile repeater), or Emergency (direct radio-to-radio contact) talkgroup.[10] This approach ensures reliable communication even if local infrastructure is compromised.

The various ways in which disaster response agencies use VIPER are shown in Figure 2.

FIGURE 2: Disaster Response Agency Roles and VIPER Use

Disaster Response Agency	Emergency Response Role During Hurricanes	Use of VIPER During Emergencies
Local Police	Evacuation of citizens from disaster-impacted areas, traffic control, security	Use the "State Event" talkgroup to coordinate with other agencies
Fire Department	Rescue operations and flood response	Communicate with EMS and Emergency Management
Emergency Medical Services (EMS)	Medical response and transport of patients	Connect to hospitals through VIPER Medical Network (VMN)[11]
Hospitals	Patient intake, triage, and resource allocation	Receive updates from EMS and Emergency Operations Center through dedicated talkgroups
North Carolina Emergency Management (NCEM)	Incident command, resource deployment, and statewide coordination	Activate "State Event" talkgroups and manage PACE planning
State Highway Patrol	Oversee VIPER and ensure system's technical stability during and after storm	Assign talkgroups and monitor network traffic

The information compiled above was gathered from North Carolina Emergency Operations Plan, December 2022 - Annex A and VMN Reference Information - November 2018.

[9] The PACE system provides disaster response agencies with a known, alternative plan of communication should the primary radio line become inoperable during a disaster. *See, e.g.*, North Carolina Strategic Communication Interoperability Plan - January 2025, pgs. 9, 15.

[10] Ibid.

[11] The VMN is "a dedicated sub-network within [VIPER]. This specialized medical communications network enables seamless, secure, and real-time communication between EMS providers and receiving hospitals across the state, enhancing coordination and patient care during emergency responses." Communications - NCOEMS.

FINDING 1 DETAILS

12 VIPER towers sustained damage from Hurricane Helene.

VIPER played an important role in connecting first responders during and after Hurricane Helene. As reported by Sergeant Richard Collie, Chief Pilot for NCSHP's aviation unit, "Early on, the only communications that we had with ground units, whether that be Emergency Management or troopers…were through the VIPER system."[12]

However, although NCSHP reported that VIPER "remained online throughout the storm and disaster response,"[13] OSA found that **12 VIPER towers sustained damage from the storm, resulting in service outages**. Five of these sites were completely non-operational, while the other seven entered an operational mode called "site trunking" in which the site remains operational for local, site-specific communication but cannot communicate with other sites.[14] As shown in Figure 3, NCSHP identified four main causes of VIPER tower outages during the storm:

- Issues with site generators;
- Microwave outage cascade effects;
- Wind damage to microwave dishes; and
- Uninterruptible power supply (UPS) shutdown failures.[15]

FIGURE 3: VIPER Sites Damaged by Helene and Cause of Outage

Site Location	Downtime	Operational or Non-Operational	Outage Causation
Avery	2 hours & 30 minutes	Non-Operational	Generator water pump failure
Ashe	3 hours & 34 minutes	Non-Operational	Generator water pump failure
Haywood	1 hour & 22 minutes	Non-Operational	Generator ran out of fuel; generator not owned, monitored, or fueled by VIPER

[12] NCDPS Helene Response - Communications.
[13] Ibid.
[14] "Site Trunking" occurs when (1) a VIPER tower only remains active and functional for local communications; (2) radios operating within the tower's coverage area while in trunking mode, and on the same talkgroup, maintain the ability to communicate with each other; and (3) the tower's only limitation is its inability to connect local users with non-local users who rely on other tower sites across the wider network. *See* email from NCSHP to OSA on July 10, 2025.
[15] Refer to Appendix 2 for more information about the causes of VIPER tower outages during Hurricane Helene that have been identified by NCSHP to date.

Site Location	Downtime	Operational or Non-Operational	Outage Causation
Buncombe	15 hours	Non-Operational	Generator alternator failure
Haywood	15 hours	Operational	Microwave outage cascade effect
Buncombe	15 hours	Operational	Microwave outage cascade effect
Haywood	15 hours	Operational	Microwave outage cascade effect
Madison	12 hours & 28 minutes	Operational	Microwave outage cascade effect
Madison	12 hours & 28 minutes	Operational	Microwave outage cascade effect
Buncombe	12 hours & 28 minutes	Operational	Microwave outage cascade effect
Watauga	97 hours & 45 minutes	Operational	Microwave dishes damaged by wind
McDowell	76 hours & 24 minutes	Non-Operational	UPS shutdown/fail

Figure 3 was provided by NCSHP to OSA. OSA made minor changes for purposes of internal consistency with the rest of this report.

At the time of this writing, the total cost for repairing damaged VIPER towers was $2,131,565.11, with an estimated **$1.2 million still needed to repair one site**.[16]

Power generation: VIPER sites run on commercially available utility electricity, with a standby generator (fueled by diesel or propane) automatically kicking in during power outages. Site generators are inspected every five to eight weeks. Diesel generators have a run time of seven or eight days, while the run time of propane generators depends on the size of the tank.[17] Ahead of Hurricane Helene, NCSHP reported conducting site inspections and ensuring that generators were properly fueled.[18]

Tower restoration: During Hurricane Helene, one of the main challenges in promptly restoring service to damaged towers was that widespread damage limited access to affected sites. Multiple agencies worked together to repair damaged locations. For example, NCEM oversaw the clearing of roadways and delivered fuel to essential towers supporting public safety and broadcast operations. NCSHP's aviation unit surveyed VIPER towers to identify those requiring fuel or repairs, while NCSHP helicopters transported diesel fuel and technicians to damaged locations.

[16] Email from NCSHP to OSA on December 17, 2025.
[17] Email from NCSHP to OSA on July 10, 2025.
[18] Memorandum from NCSHP to OSA on October 2, 2025, pg. 6.

Call volume: NCSHP provided OSA with a sample of calls processed by VIPER between September 23, 2024 and October 9, 2024. During this period, Zone 2, which covers the western part of the state and contains 103 VIPER tower sites, received 2,929,944 calls, of which 172,926, or **5.9%, returned a busy signal**. According to NCSHP, the VIPER system **typically has a busy-signal rate of less than 0.03%** during standard statewide operations.[19] This significant difference in busy rates underscores the high volume of calls made through VIPER towers during natural disasters and the essential role VIPER plays in times of crisis.

FINDING 2 DETAILS & RECOMMENDATIONS

A third-party assessment of VIPER revealed significant weaknesses.

During our review, OSA discovered that a third party, the McChrystal Group,[20] conducted an after-action review of NCEM's disaster preparedness and response to Hurricane Helene, including how VIPER performed during the storm.[21] The McChrystal Group stated the following:

- "A complete communications blackout revealed significant weaknesses in the VIPER radio backup communication system."[22]
- The blackout "highlighted insufficient integration of satellite-based communication alternatives."[23]
- "[M]any responders in impacted areas [were left] with little to no communication capability to mobilize and coordinate response operations."[24]

[19] Email from NCSHP to OSA on July 10, 2025.
[20] The McChrystal Group is a Virginia-based leadership and management advisory firm which serves "to optimize . . . organization[s] without compromising performance." https://www.mcchrystalgroup.com/about.
[21] North Carolina State Emergency Response Team: Hurricane Helene After Action Review - Final Report. While not the focus of our review, NCSHP also provided OSA two reports previously released about VIPER: a report issued in 2004 by the Criminal Justice Information Network Governing Board and the Department of Crime Control and Public Safety to the North Carolina General Assembly, which identified VIPER as a viable program for North Carolina; and a report issued in 2018 by the Program Evaluation Division of the North Carolina General Assembly which compared the viability of VIPER to the technologies offered by FirstNet, a wireless broadband network hosted by AT&T that also exists in North Carolina for use by first responders.
[22] North Carolina State Emergency Response Team: Hurricane Helene After Action Review - Final Report, pg. 1.
[23] Ibid.
[24] Ibid., pg. 15.

- "[R]esponders or responder teams with a VIPER radio on hand could not consistently and effectively leverage the network due to user error and excessive traffic on the system."[25]
- Many users experienced a "bonk sound," which occurs "when [users are] unable to connect to the system or access a channel. This typically occurs when the system is overloaded with too many users transmitting simultaneously, the user is on the wrong channel or zone, incorrect radio operation or programming prevents access, or coverage gaps exist in certain areas. Several county emergency managers reported experiencing delays of over an hour when attempting to share or request information through the VIPER system."[26]

NCSHP confirmed that upon hearing an error tone, users would hang up and then call back. This resulted in these users being rerouted to the back of the queue.[27]

RECOMMENDATIONS

Because only 45 of North Carolina's 100 counties use VIPER as their primary, mission-critical land mobile radio system for emergency response, **the potential exists for confusion and miscommunication during large-scale disasters**. In light of our findings and the findings of the McChrystal Group, OSA recommends that further work be done to evaluate whether VIPER remains the most cost-effective and efficient communication network for disaster response agencies in North Carolina. Among the issues to be addressed include:

- The advantages and disadvantages of land-based systems like VIPER compared to currently available satellite technology;
- VIPER's resilience in the face of natural disasters, as well as the system's long-term viability and durability;
- The potential impacts of making VIPER the default radio system used when a natural disaster or emergency occurs in North Carolina;

[25] Ibid.
[26] Ibid.
[27] Email from NCSHP to OSA on July 10, 2025.

- Whether VIPER users should be required to pay a fee to NCSHP for use of the system, and whether proceeds from these fee collections should be allocated to support VIPER's continued operations; and
- Ways to prevent system overloading, like that which occurred during Hurricane Helene.

OBSERVATION

Continued Issues with Funding VIPER.

Costs associated with running VIPER include the purchase of infrastructure (e.g., radios, equipment, software updates, and cell towers). To receive funding to support such purchases, NCSHP primarily requests appropriations from the North Carolina General Assembly; however, additional funding comes from federal grants and in-kind contributions from local governments.[28] Citing "ongoing funding shortfalls and the expanding growth" of VIPER, NCSHP has requested $70,065,705 in recurring and nonrecurring funds since State Fiscal Year (SFY) 2022 for, among other things, additional positions, salary adjustments for existing staff, maintenance, tower rebuilds and construction, and generator upgrades.[29] In October 2025, the North Carolina General Assembly approved a permanent $2.1 million annual increase in State funding to support VIPER, the first recurring increase since 2016.[30]

During our review, OSA identified several additional funding concerns raised in NCSHP's VIPER Quarterly Report to the Joint Legislative Committee on Justice and Public Safety, issued on November 12, 2025.[31] These concerns are summarized in Figure 4.

FIGURE 4: VIPER Funding Concerns as of November 2025

Funding Area	Issue Identified	Amounts (as stated)	Nature of Funding	Key Risk/Impact
Overall Budget Baseline	Current budget is materially below prior levels despite system growth and new infrastructure needs	Budget is $2,062,236 less than SFY 2018-19 even after $2.1M recurring added by Session Law 2025-97	Recurring	Insufficient resources to support expanded system and new sites

[28] VIPER and FirstNet are Vital for Public Safety Interoperability, but VIPER Requires Upgrades - April 2018.
[29] Email from NCSHP to OSA on June 27, 2025.
[30] *See* Section 5.1 of Session Law 2025-97; North Carolina Expands VIPER Funding for First Responders' Statewide Radio Network - NewsBreak.
[31] VIPER Quarterly Report - November 2025.

Funding Area	Issue Identified	Amounts (as stated)	Nature of Funding	Key Risk/Impact
Additional Tower Sites	Need for new sites after completion of original 241-site build	31 additional sites needed in western NC; $4,162,236 removed from VIPER for construction of new towers in SFY 2018-19	Capital and Recurring Operations & Maintenance	Coverage gaps; higher future construction costs due to delays
Personnel Staffing	Insufficient number of positions to support full system build-out and user growth	31 additional positions requested; no specific dollar amount listed	Recurring	Recruitment/retention failures; reliance on repeated vacancies; operational risk
Salary Adjustments	Unable to implement salary adjustments authorized by Session Law 2025-89	No specific dollar amount listed; VIPER has no salary reserves available to implement the adjustments permitted by Session Law 2025-89	Recurring	Loss of staff to higher-paying local government and private sector jobs
Operations & Maintenance (O&M)	O&M funding does not match system size and aging infrastructure	$2.1M recurring added by Session Law 2025-97, but described as insufficient for current/future needs	Recurring	Deferred maintenance, delayed repairs, increased outage risk
Deferred Replacements	Replacement cycles pushed to future years due to funding shortfalls	No single amount; affects multiple asset categories	Recurring / Capital	Higher long-term costs and system reliability issues
Tower Replacements (One-time)	Structurally unsound towers cannot be replaced with current funding	$9.5M one-time needed to replace already-identified towers	One-time	Imminent risk of site failure and loss of service
Zone Controller Redundancy	No redundancy for the Zone Controllers which serve as the “brains” of the VIPER system	$6.8M requested to purchase 4 redundant controllers	Capital	Large-scale outages affecting tens of thousands of users for potentially more than 30 minutes at a time
Microwave Upgrade Project	Legislatively funded project still underway; nearing completion	No new amount requested; prior funding cited	Capital (previously funded)	Risk if future funding is not sustained for lifecycle support
Simulcast Prime Site Replacement	Equipment reaching end of life manufacturer support in 2029	$2.5M estimate; funding needed by end of FY 2027	Capital	Loss of vendor support and potential service disruption
Motorola GTR Base Station	System-wide base stations reaching end	$247.6M estimate to replace all stations	Capital (long-term)	Major statewide outage risk due to

Funding Area	Issue Identified	Amounts (as stated)	Nature of Funding	Key Risk/Impact
EOL	of life in 2032			parts unavailability
TDMA / P25 Phase 2 Upgrade	Infrastructure upgrade required to realize mandated TDMA subscriber upgrades	$20M previously requested	Capital	Capacity constraints persist despite TDMA-capable radios

The data contained in Figure 4 is a summary of the ongoing needs of VIPER as identified by State Highway Patrol Commander Freddy Johnson in his November 2025 Quarterly to the Chairs of the Joint Legislative Oversight Committee on Justice and Public Safety.[32]

NCSHP maintains that:

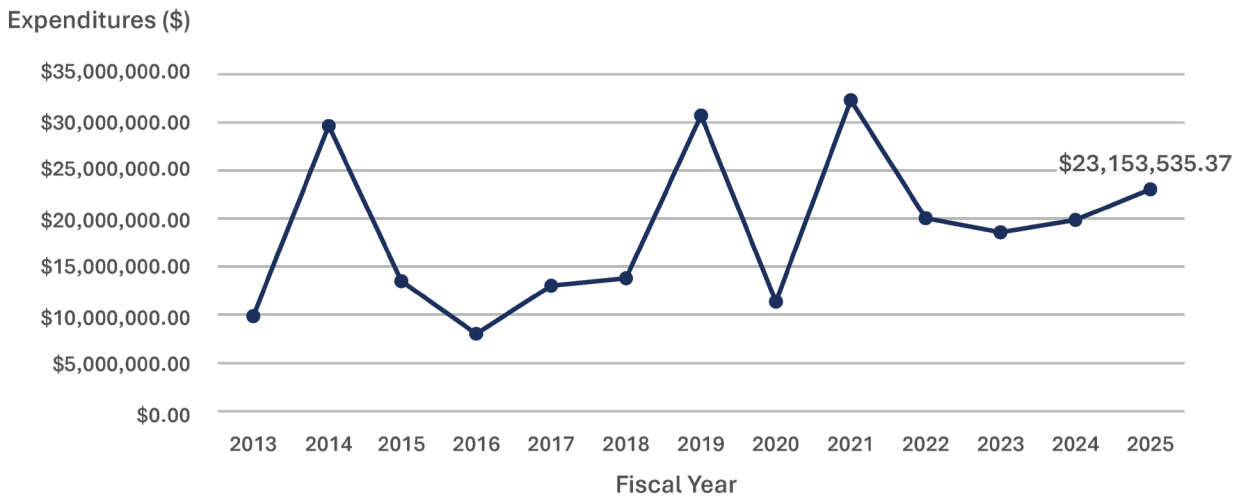
- Without increased operations and maintenance funding, VIPER will be unable to sustain system readiness or address outages, like those that occurred during Hurricane Helene, in a timely manner; and that
- Many VIPER towers are in dire need of replacement due to age and/or overloading.[33]

VIPER Expenditures and Appropriations

From SFY 2013 to May 2025, VIPER expenditures amounted to $245,796,471.15. Figures 5, 6, and 7, further break down this number.

[32] Ibid.
[33] *See, e.g.*, VIPER Quarterly Report - April 2025.

FIGURE 5: VIPER Expenditures from SFY 2013 to May 2025



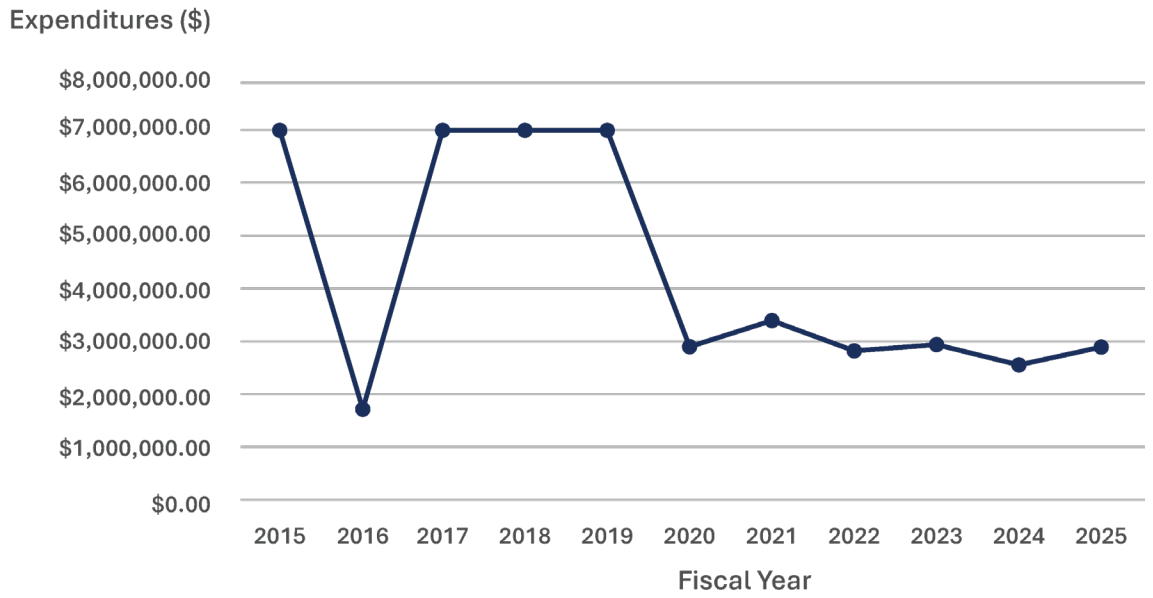
The data contained in Figure 5 was provided by NCSHP to OSA.

FIGURE 6: VIPER Expenditures Compared to Appropriations/Transfers, SFY 2013-2024

Fiscal Year	Expenditure	Appropriation/Transfer	Variance	Number of Sites Activated
2013	$10,163,155.89	$9,932,246.02	$230,909.87	
2014	$29,856,817.54	$29,842,589.34	$14,228.20	5
2015	$13,651,643.28	$13,602,259.14	$49,384.14	6
2016	$8,130,945.03	$7,723,649.79	$407,295.24	2
2017	$13,219,199.94	$13,208,851.32	$10,348.62	3
2018	$13,998,687.98	$13,994,135.50	$4,552.48	5
2019	$30,799,365.62	$30,785,602.95	$13,762.67	5
2020	$11,629,718.33	$11,538,792.07	$90,926.26	4
2021	$33,956,744.27	$32,158,414.55	$1,798,329.72	1
2022	$20,406,464.01	$20,058,788.47	$347,675.54	3
2023	$18,632,162.70	$23,988,254.71	**($5,356,092.01)**	2
2024	$19,839,748.97	$12,008,278.36	$7,831,470.61	0

The data contained in Figure 6 was provided by NCSHP to OSA. The number of sites activated data contained in was provided by NCSHP in an email to OSA on October 1, 2025

FIGURE 7: Annual Cost of VIPER Tower Construction from SFY 2015-May 2025



The data contained in Figure 7 was provided by NCSHP to OSA and was created by sorting VIPER's financial reports from SFY 2015-2025 by VIPER tower construction. NCSHP provided annual total costs of tower construction rather than a breakdown of the cost of construction for each tower.

RESPONSE FROM Voice Interoperability Plan for Emergency Responders (VIPER)

North Carolina State Highway Patrol

Josh Stein
Governor

Freddy L. Johnson, Jr.
Commander

September 26, 2026

State Auditor David L. Boliek
North Carolina Office of the State Auditor
20601 Mail Service Center
Raleigh, NC 27699

Dear State Auditor Boliek:

VIPER and the North Carolina State Highway Patrol appreciate the opportunity to respond to the findings presented in the Rapid Response Report. Ensuring the continued viability and effectiveness of the VIPER system remains a core priority for Highway Patrol leadership. Delivering the highest-quality communications network for our users is essential to safeguarding both the citizens of North Carolina and the first responders who serve them. The following section outlines our detailed responses to the report's conclusions.

VIPER acknowledges the findings issued by the North Carolina Office of the State Auditor and appreciates the professionalism demonstrated by your staff throughout this review. This engagement has been constructive, and we value the opportunity provided through the Rapid Response Special Report to address several key issues, many of which have already been resolved or are actively being addressed through ongoing initiatives.

Infrastructure Realities and Satellite Integration

As noted in the findings from the audit and the McChrystal Group report, concerns were raised regarding insufficient integration of satellite-based communications alternatives. The VIPER section neither the Highway Patrol were ever contacted by the McChrystal Group prior to the release of their After-Action Review. It is critical to recognize that at the time of Hurricane Helene, integrating satellite backhaul was physically impossible because VIPER utilized legacy T1-based microwave transport—essentially relying on older, traditional copper-line circuit data pathways that lacked modern broadband flexibility.

As highlighted in past VIPER quarterly legislative reports, funding delays continually hindered our ability to migrate the network to MPLS (Multiprotocol Label Switching) Ethernet transport, which functions like a modern, high-speed digital highway for network data. Furthermore, NC Session Law 2021-180 Section 19B.4.(a) required VIPER to go through a formal RFP process which further delayed the awarding of a contract to replace T1 microwave equipment with MPLS Ethernet equipment. This delay caused the contract to not be formally awarded until May 2024,

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resulting in a delay from bill ratification on November 18, 2021, until May 2024 o get a contract in place to replace legacy equipment. This specific statutory and procurement delay further highlights how VIPER's forward vision continues to be hindered by legislative processes that directly impact first responder communications.

This migration was strictly required by Motorola for system support and serves as the necessary foundation o utilize LEO (Low Earth Orbit) satellite backup alternatives should a microwave server or path failure occurs. VIPER migrated o full MPLS Ethernet transport in the first half of CY 2026.

As the audit report noted, VIPER suffered several microwave cascade outages. If VIPER had been operating on MPLS Ethernet transport with Starlink terminals available, the potential existed to restore service to impacted towers while downstream sites were undergoing repairs. VIPER strongly desires o utilize LEO Starlink technology a any non-ring topology microwave path sites, but our current budget lacks the ability o purchase the required terminals and pay the recurring monthly subscriptions for this service. Deploying LEO technology a these "spur microwave" sites—isolated endpoint towers lacking redundant pathways—would further diminish the impact of cascading microw ave events. With our fully deployed MPLS network architecture, intelligent dynamic routing protocols can be configured to make this failover seamless. By assigning lower link costs to our primary microwave pa hs and higher costs to secondary Starlink connections, the network naturally prioritizes the high-capacity terrestrial microwave backbone. If a microwave path is severed, the MPLS routers instantly detect the change and automatically shift traffic o the Starlink backup pa h. Because of how these protocols manage traffic priority, this automated switching transition is nearly hitless, maintaining continuous connectivity for the site.

To build inherent resilience, VIPER installed a significant amount of new MPLS ring microwave sites as part of the ethernet microwave upgrade to add multiple paths of redundancy. Furthermore, all microwave radios were purchased as "Hot Standby," meaning they were acquired with double industry-standard parts o ensure maximum availability during equipment failures. Because industry standard is non-hot standby, which features only one set of equipment per path, this choice demonstrates VIPER management's unwavering commitment o resiliency during normal and adverse weather conditions.

[1] https://www.ncleg.gov/enactedlegislation/sessionlaws/html/2021-2022/sl2021-180.html

Direct-to-Satellite Limitations and Funding Constraints

Unlike commercial broadband applications where the dropped packets or temporary disconnects are a minor inconvenience, VIPER carries critical, life-safety Land Mobile Radio traffic every single second of every day. Public safety communications demand absolute reliability, predictable latency, and uncompromised availability—tolerances that leave zero room for error when a first responder's life or a community's safety hangs in the balance. This mission-critical reality is precisely why VIPER remains deliberate and cautious regarding emerging satellite and Direct-to-Cell technologies, ensuring that any adopted tool meets the rigorous, life-sustaining standards required before it touches our emergency infrastructure.

It is also vital to note that satellite technology and Direct-to-Satellite (D2S) capabilities are emerging options, whereas Land Mobile Radio (LMR) has served as the foundational, trusted standard for emergency responders for decades. Furthermore, traditional LMR subscriber units feature direct device-to-device (talk-around/conventional) capabilities, allowing first responders to communicate directly with one another even during a complete failure of local repeater infrastructure. In contrast, satellite and emerging D2S technologies offer no inherent device-to-device fallback capability if the overarching network infrastructure goes down.

Additionally, while LMR networks are publicly owned and operated at the local and state levels, current LEO satellite technologies are privately owned corporate assets. As demonstrated during geopolitical conflicts such as the war in Ukraine, commercial satellite coverage can be restricted, altered, or turned off entirely in specific operational areas due to corporate or political decisions. Relying on privately owned infrastructure means public safety agencies surrender direct control over their network access and cannot independently guarantee uninterrupted service during critical missions.

During Hurricane Helene, out-of-state resources deployed into North Carolina from state, local, and federal partners. Agencies equipped with P25-capable 7/800 MHz radios integrated seamlessly into the system, achieving immediate interoperability with existing VIPER users. Adopting alternative unproven technologies would risk leaving incoming out-of-state agencies without interoperability unless large, expensive caches of specialized radios were maintained.

Other states recognize the unmatched value of sustaining and hardening existing LMR infrastructure. For instance, Tennessee is expanding its statewide LMR network (TACN) and has invested substantial funding to adopt features like Dynamic System Resilience (DSR)—a capability VIPER has requested funding for over several years. Recent evaluations underscore the immense value of North Carolina's unified interoperable approach, with states like Texas actively

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examining how fragmented communications exacerbate disasters and looking toward comprehensive shared networks as an ideal standard. [2][3][4]

While the number of satellites is increasing, orbital mechanics introduce real-v such as Kessler Syndrome and historical precedents like Starfish Prime. Furthermore, LEO solutions only operate effectively in open areas with a clear view of the sky; they do not function indoors or in locations with dense foliage coverage. This limitation mirrors current challenges faced even by high-pressure cellular deployments.[5][6]

Developed by the Outer Space Institute, the CRASH Clock is a specialized environmental indicator tracking collision risks and congestion in lo Earth orbit. It measures the expected time until a catastrophic satellite collision would occur if all orbital maneuvering abruptly ceased or tracking capabilities were lost. The timeline has shortened dramatically with the rise of commercial mega constellations: back in 2018, the expected time-to-collision stood at a comfortable 164 days, but relentless orbital crowding has driven that figure down to just 2.2 days.[7][8]
Major cellular and LTE infrastructure providers view satellite connectivity as a supplementary coverage tool rather than a viable replacement for terrestrial networks as well. Industry analyses emphasize that satellite systems fundamentally lack the massive data capacity, low latency, and high spectral efficiency required to handle dense, high-volume urban and suburban user traffic. Consequently, telecom operators position satellite links strictly as niche solutions for remote rural gaps rather than core infrastructure substitutes.[9]

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[2] https://www.tnsgov/safety/tacn/sacn-timeline.stmls

[3] https://communitvis pact.com&centra -austin/texas-legis ature/cos smunication-issues-among-fisst-responders-can-s exacs batesdisasts s-tsx as-officials-say/ s

[4] https://www.tn.gov/governos/news/2023/4/23/gov--s -s-full--tennessee--leading-ts -nation--agenda-passes. tm ls

[5] https://www spacesafetymagazine com/space-debs s/kessles-syndsome/s

[6] https://www.thespaceseviewscom/article/4822/1s

[7] https://outs spacsi nstitutesca/crashcsock/s

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VIPER fully recognizes the value of Starlink LEO technology as a supplemental tool, but given our well-documented budget constraints, we have not even factored in deployment costs. Diverting funds toward a backup-to-the-backup would pull critical resources away from day-to-day infrastructure maintenance.

Network Capacity, User Training, and TDMA Migration

The McChrystal Group report noted on page 22 that the traffic capacity of the VIPER radio network should be upgraded, and that increased access and user training should be expanded. Building on this, the state auditor report observed that responders or response teams could not consistently leverage the network due to user error and excessive traffic. Many users experienced a "bonk sound"—an audible tone indicating a channel is busy or inaccessible—caused by system overloads, incorrect channel zones, programming errors, or coverage gaps, with several county emergency managers reporting delays exceeding an hour when sharing information.

VIPER busy and system saturation was further impacted by the fact that county or locally owned public safety communications systems failed entirely, leaving local agencies with no other means of communication than VIPER. This additional loading—comprising normal traffic, emergency traffic, local agencies switching over, and responding agencies arriving from across the state and nation—created a situation of unprecedented loading. When no other form of communication existed due to local infrastructure failure, VIPER served as the primary communications lifeline for many agencies for days and weeks.

While amateur radio, Starlink, and satellite phones played a vital role in passing life-safety traffic and deserve substantial recognition, when all else failed, users shifted to VIPER. Discussions at Land of Sky Regional Council meetings following Helene highlight that the FCC has shown intense interest in the region's communications environment, as this event represented the closest scenario to a total communications blackout in the contiguous 48 states in history. Despite the failures VIPER experienced, it remained the most utilized communications medium during and after the storm for responding agencies. Restoration time was hampered exclusively by physical access constraints to tower sites under unprecedented weather conditions, with North Carolina State Highway Patrol and National Guard air resources utilized or planned to drop in fuel supplies to keep this vital infrastructure running.

VIPER began issuing guidance as early as July 2019 indicating that the network was migrating to TDMA (Time Division Multiple Access) technology—a digital transmission method that splits single radio channels into multiple distinct time slots to double voice capacity—and that subscribers needed to acquire TDMA-capable radios. However, the state still needs to fully fund

the remaining license costs owed to Motorola, an item repeatedly highlighted in required VIPER reports to the legislature.

TDMA technology doubles available voice traffic paths across the VIPER system. As previously communicated data shows, when TDMA was activated during Helene, it yielded an immediate and drastic reduction in system busy signals. Had all first responder radios been TDMA-capable, busy conditions would have decreased significantly. Recognizing this, the North Carolina Statewide Interoperability Executive Committee (NCSIEC) listened to user feedback and requested that talk groups under their management move to TDMA-only operations on July 15, 2025, heavily impacting emergency communications positively.

To directly address training gaps, VIPER is collaborating with all approved radio vendors to place accessible training modules on the VIPER website for all end users, keeping them updated with future manufacturer releases. Led by Mr. Shane Autrey, this project is targeted for deployment in Q4 2026 or Q1 2027.

VIPER believes the reported one-hour delays stemmed from user error compounded by system overloading. While historical data no longer exists, properly trained VIPER field staff experienced brief busy signals lasting up to two to three minutes, but none that prevented passing traffic for extended periods. Many responders were unfamiliar with standard radio busy tones, causing them to repeatedly re-key their Push-To-Talk (PTT) buttons and inadvertently push themselves to the back of the transmission queue. The upcoming training videos will directly educate our user base on this behavior.

Tower Hardening and Generator Maintenance

Following Hurricane Helene, Tower Industry Association (TIA) inspections that were previously restricted strictly to state-owned towers are now being performed on non-state-owned towers exclusively encompassing state-owned assets. This initiative identifies unknown antenna and coaxial cable (coax) issues while installing secondary high-wind stiff arms on all VIPER-owned microwave antennas. Led by Mr. Max Casey, this ongoing project will take the next 3 to 4 calendar years to complete. While it presents a substantial cost to our limited budget, VIPER recognizes it as an absolute priority for network sustainability.

VIPER acknowledges that failures occurred with generators and uninterruptible power supplies (UPS)—battery backup systems designed to maintain short-term power during commercial outages—during the storm, highlighting deep budgetary constraints. The program lacks the staff and funding required for cyclical replacements of power systems, leading to aging equipment with no replacement pathways. While items like water pumps, belts, and alternators require regular

cyclical change-outs, having just a single generator technician cover half the geographical area of the state and manage over 100 generators makes comprehensive preventative maintenance impossible at present. VIPER wants to institute cyclical generator maintenance as units age, but current staffing and funding levels preclude it.

User Fees and Sustainable Funding Alternatives

Regarding potential user fees, VIPER previously provided data from the mandated 2018 Program Evaluation Division (PED) study, which explicitly advised against adopting such fees. Implementing user fees would be counterproductive and would contradict prior commitments related to in-kind sharing. If users were required to pay fees in addition to providing in-kind support, many would likely begin charging the state for facility lease costs in return. Colonel Johnson has strongly opposed any form of user fees for the VIPER system and has consistently advocated against them.

Stakeholders have already warned VIPER management of the likely outcome: if local fees are assessed, VIPER could face a negative fund balance should local lease expenses exceed state collections. Instead of pursuing user fees, VIPER and the Highway Patrol support alternative legislative funding mechanisms. One such option is House Bill 695, introduced in 2025, which proposes allocating a portion of the 911 tax to sustain VIPER. This legislation represents a sound and effective funding strategy, and VIPER and the Highway Patrol remain open to any comparable proposal the General Assembly may consider.

Having served as North Carolina's primary interoperability and disaster-response network for more than two decades, VIPER cannot be replaced without extraordinary capital investment, lengthy implementation timelines, and severe disruption to emergency communications. Fully funding VIPER at requested legislative levels is critical to keeping the system secure, reliable for daily operations, and resilient during future emergencies.

The extreme challenges experienced during Hurricane Helene underscored the difficulty of operating under unprecedented conditions but also reinforced an undeniable reality: VIPER remains North Carolina's essential public safety communications backbone. Addressing audit findings does not require replacing this proven terrestrial land-mobile radio (LMR) architecture with high-risk, consumer-focused commercial technologies. The path forward is targeted, sustainable investment in VIPER's core LMR infrastructure—consistent with the funding approach outlined in House Bill 695.

Providing full support for key upgrades—including MPLS backhaul expansion, tower hardening, Motorola TDMA software licensing, routine generator and power system replacements, and the

personnel required to operate and maintain the statewide network, as outlined in recurring reports to the General Assembly—will directly alleviate capacity constraints and resource shortages. These investments are the most effective way to ensure that VIPER remains robust, secure, and capable of protecting North Carolinians when every second counts.

The North Carolina State Highway Patrol and VIPER appreciate the professional partnership with the State Auditor's Office and look forward to continuing that collaborative relationship.

Sincerely,

Col. F. L. J.

Freddy L. Johnson, Jr.
Commander

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