

NENA NG9-1-1 Operational Impacts on the PSAP

Abstract: This Document is intended to give Authorities Having Jurisdiction (AHJ) and PSAP Administrators an understanding of how NG9-1-1 may impact their agency and provide guidance and options to assist in decision making as they transition to NG9-1-1.



NENA NG9-1-1 Operational Impacts on the PSAP Information Document

NENA-INF-041.1-2021

DSC Approval: 09/21/2021

PRC Approval: 11/01/2021

NENA Board of Directors Approval: 11/17/2021

Next Scheduled Review Date: 11/17/2024

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Published by NENA

Printed in USA



1 Executive Overview

Before a Public Safety Answering Point (PSAP) takes advantage of the features and functions that NG9-1-1 allows the operational impacts must be understood and addressed. This document is meant to provide an Authority Having Jurisdiction (AHJ) and/or PSAP Administrators information regarding operational impacts and options that might be considered to address these impacts.

NG9-1-1 provides PSAPs with the capacity and speed to receive, process, share, and communicate information from a variety of sources. PSAPs vary in resources and services provided. Many of the features and functions available to the NG9-1-1 PSAP are optional. Before deploying features and functions that may impact their operations, administrators should assess their needs and the value of these features and functions to their specific operations and whether they have the resources, the policies and procedures, the supervision, and the contingency plans necessary to efficiently implement and operate these new features and functions provided by NG9-1-1.

While this document provides valuable information for consideration by AHJs and PSAP Administrators, until more PSAPs deploy NG9-1-1 features and functions, not all operational impacts of the new capabilities will be known. It is important that AHJs and PSAP Administrators take the time necessary to make informed decisions regarding changes that may impact operations.

This informational document is intended to be a tool for PSAPs and not an inflexible roadmap to NG9-1-1 deployment. This document will change as NG9-1-1 evolves. Given the increased level of data collection in the NG9-1-1 PSAP, NENA strongly encourages PSAP administrators to review any applicable federal, state, and local laws and regulations regarding retention, management, and access of stored electronic information and records, including but not limited to those laws and regulations addressing open records acts, chain of custody, evidence retention, warrant requirements, and secure destruction policies.

Adoption of NG9-1-1 technologies may require a change in the traditional work roles within the PSAP. Technology advances like the use of video in emergency communications and the ever-increasing proliferation of sensors and other data generators may expand the traditional roles of PSAP Telecommunicators and thereby increase the scope of PSAP operations beyond where they are today. While this paper focuses on NG9-1-1 as it may impact the Public Safety Emergency Communications function, it recognizes that traditional PSAPs will evolve with expanded functions and services in response to the advent of new NG9-1-1 capabilities.



PSAP Administrators and AHJs are encouraged to reference NG9-1-1 guidelines and standards published by NENA, APCO, and other relevant Standards Development Organizations (SDOs).

While the term PSAP is widely used throughout the document (and is the currently accepted shorthand term for a 9-1-1 Center) the term Emergency Communication Center (ECC) is also used in this document to describe a 9-1-1 Center.



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Reason for Issue/Reissue

NENA reserves the right to modify this document. Upon revision, the reason(s) will be provided in the table below.

Document Number	Approval Date	Reason For Issue/Reissue
NENA-INF-041.1-2021	11/17/2021	Initial Document



2 Preamble

The current E9-1-1 network infrastructure was developed over 40 years ago and consists of wireline technology and Time-Division Multiplexing (TDM) switched legacy platforms. It was not developed to transmit text messages and data such as pictures and video to ECCs. The NG9-1-1 system is designed to recognize the device and type of message (voice, text, photo, or video) and will be capable of routing and delivering this information to ECCs. Enhanced policy routing (exception routing control) will allow agencies to provide rules regarding the treatment of calls. Wide-area transfer capabilities and data sharing across cooperating AHJs and Next Generation 9-1-1 ECCs are facilitated with NG9-1-1. For example, county to county, region to region, state to state, and international transfers are all made possible by the deployment of NG9-1-1 technology.

E9-1-1	vs	NG9-1-1
Complex analog trunking and data network		Engineered, managed IP networks Multi-Protocol Label Switching (MPLS) networks (Emergency Services IP Networks or ESInet)
Class 5 switch for Selective Router		IP software selective routing function Custom call management applications (Emergency Services Routing Proxy and Policy Routing Function or ESRP/PRF)
Translation based control		GIS and database controls Highly accurate GIS (Emergency Call Routing Function and Location Validation Function or ECRF/LVF)
Limited to voice calls		Voice, text, video, telematics, Internet of Things (IoT, ability to transfer data over a network without requiring human-to-human or human-to-computer interaction)
Bandwidth fixed based on configuration		Bandwidth dynamically scalable
Complex Emergency Gateway Network for VoIP		Direct handling of Internet sourced calls Security functions (Border Control Function or BCF)
Custom interfaces for each service type		Standard IP interface for all service types Standards-based protocols (from NENA, IETF, etc.)



3 Policies and Procedures

Policies and Procedures for use of NG9-1-1-supplied data should be developed and/or updated to address operational changes driven by the implementation of NG9-1-1 prior to adding these features and functions to ECC operations. Operational changes will depend on which Policies and Procedures are required and what services are being provided by any undertaken NG9-1-1 implementation.

4 Multimedia

A NG9-1-1 multimedia call can provide:

- interactive media intended for communication between the Telecommunicator and the caller (audio, video, text)
- interactive media intended for communication between the Telecommunicator and the relay service on behalf of the caller (audio, video, text)
- Streaming non-interactive media (live camera feeds)
- Static pictures, videos, or recordings

Policies and Procedures should be developed to address how multimedia will be used to interact with citizens, responders, and support organizations in order to enter, prioritize, and dispatch incidents. The ECC administrator may consider the need for specific policies for each category of media.

Questions to consider:

- Will pictures and video be used to determine call priority or as supplemental information?
- Will pictures and video be shared with responders and if so in what format, under what circumstances and with whom?
- How will third party multimedia be associated with the correct incident?
- Will live video calls allow the caller to see the Telecommunicator?
- Will these be viewable by Telecommunicators?
- Will you utilize a Communications Analyst type position?
- If a Communications Analyst position is used, will it be internal or external?
- If pictures and videos are viewable, should the agency have a policy regarding storage, retention, deletion, chain of evidence, and sharing?
- How will data be maintained and archived?
- What are the evidentiary or legal ramifications (Criminal Justice Information Service (CJIS), Health Insurance Portability and Accountability Act (HIPAA), etc.) of using NG9-1-1 supplied data in ECC operations?
- Will you have capability for multi-party video conferencing?



4.1 Multimedia Display

Call handling system vendors should consider the following points as guidelines in developing Human-Machine Interfaces (HMI). These solutions should support the following HMI requirements:

- Provide the capability to automatically launch the appropriate multimedia module for the call type.
- Provide the flexibility to determine screen launch location as configured by the System Administrator.
- Provide the capability to restrict/minimize the display of incoming video conferencing with a single action option.
- Provide the capability to block outgoing video conferencing with a single action option.
- Allow a Telecommunicator to enlarge or decrease the size of the multimedia module(s). The local system administrator should have the ability to create single action options to have the multimedia module displayed at preset sizes.
- Provide the capability to notify the Telecommunicator when multimedia attachments become available and allow the Telecommunicator to choose to view them or not.
- Provide the capability to establish trackable text messaging internal to the ECC with a minimal number of actions.
- Provide a configurable option for the Telecommunicator to handle multiple SMS text calls at the same time.
- Provide the capability to visually distinguish between parties within the text conference.
- Have the capability for the Telecommunicator to change the display of data within specific modules (font type, size, color etc.) as allowed by the local system administrator.
- Provide the Telecommunicator with a single action option to put an existing text call into queue status with all call record information attached to the call.
- Provide for configurability to allow either automatic or manual activation of a video call/conference with the calling device.

5 Supplemental/Additional Data

While supplemental data has been available for many years, NG9-1-1 provides the ability for an ECC to receive supplemental data from more sources than are available today. Policies and procedures should be developed to address the viewing and use of supplemental data such as Advanced Automatic Crash Notification (AACN) (see section 11), additional location elements, media, medical, and voluntarily provided information, etc.



Medical data provided must be protected from erroneous distribution; procedures should be developed to address inadvertent distribution of protected information.

Policies and procedures should be developed to address the sharing of supplemental data with support agencies (i.e., Crisis Centers, Public Works etc.).

6 Social Media

Prior to any implementation of social media by an ECC, policies and procedures should be developed that clearly define the role of social media, restrictions on its usage, and expectations of employee behavior. Written policies should clearly define that the dissemination and/or disclosure of any criminal justice or medical information, including documents or photos, related to the agency's operations or its employees' privileged information is strictly prohibited and could pose a liability threat to the agency and potentially damage any ongoing investigations. Administrators must ensure they are following state and local retention regulations.

During larger events it can be expected that social media will provide additional data about associated emergencies. The ECC administrator should consider how information from social media will be received, analyzed, and acted upon. Policies and procedures should be developed to address different types of social media, including the sources to be monitored and the frequency of monitoring, broadcasting, and receiving notifications.

ECC's may need to identify personnel responsible for these potential channels:

- **Directed:** Monitor messages directed towards the ECC (Tweet, Twitter Direct Messages, Facebook post, Facebook Messenger, hashtags, other social media messaging, etc.). Citizens are likely to attempt to make a request for assistance by any means available to them, e.g., Facebook post to an agency's Facebook page.
- **Broadcast:** Pushing messages through social media (status updates, requests to citizen groups) to the general public
- **Scanning:** Monitor social media (non-directed social media), including citizen groups, ad hoc, or other.
- **Provider Notifications:** Social media service providers notify the ECC of a potential event.

7 Recruitment and Retention

The skills needed to succeed as a Telecommunicator will change as a result of the implementation of NG9-1-1. Going forward, additional position types may be necessary in the ECC. As a result, the recruitment and retention methods used should be adjusted to
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ensure that people with the right skills are hired. The need for Telecommunicators with additional skill sets may require agencies to recruit from a different pool of candidates than they have recruited from before. Agencies should consider a retention strategy which includes a succession plan, career ladder, professional development, other public safety support positions, longevity incentives, and educational incentives.

As an ECC adjusts its recruitment and retention strategy, it is important to update job descriptions to reflect changes to duties and responsibilities driven by the implementation of NG9-1-1. Strategies should consider if the positions are union, guild, civilian, or sworn/certified law enforcement.

Recruiting from Community Colleges and Universities with degree programs in public safety or computing may increase access to a candidate pool with a higher skill level. Of note, several organizations have launched high school programs that focus on public safety, which may further increase the pool of qualified future applicants.

8 Task Analysis and Staffing Assessment

As NG9-1-1 technology is introduced and used to manage emergency incidents, the traditional tasks of Telecommunicators and other emergency services personnel need to be revisited and analyzed for relevance. In addition, future organizational responsibilities and the areas of overall emergency management applicable to the ECC will have to be studied and determined. NG introduces not only potentially new tasks in the ECC, or new ways of doing established tasks, but it also drives the need for an overall re-assessment of the ECC function and where this type of organization sits in the public safety management workflow continuum. For example, how will the ECC and the Emergency Operations Center (EOC) relate to each other in the future? Will the ECC become a part of the wider EOC operation, or will it remain standalone? How will organizational change, if any, driven by the adoption of NG technology affect roles and responsibilities in the ECC? Questions like these will necessitate not only task analysis but organizational study and analysis as well.

In addition to the organizational analysis called for above, based on the availability of new data sources and functionalities, existing tasks may need to be modified or new tasks and/or protocols introduced. This means an entire "task performance analysis" of the ECC function is probably called for in the wake of the adoption of new technologies.

The AHJ will have to determine if the ECC needs to assume new tasks which may, in turn, require new roles, such as network engineer, social media analyst, etc. to be established in the Center.

The addition of new technology such as artificial intelligence and/or machine learning may enable the ability to replace or augment manual interaction and improve situational



awareness. This new reality, in turn, may provide the opportunity to realign personnel and/or create new roles in the center, as mentioned.

ECC authorities should understand the necessary skills and resources needed to complete the tasks that may be added, reduced, or transformed. For example, the use of the Automated Secure Alarm Protocol (ASAP)¹ to deliver alarm information to the ECC may reduce the number of incoming calls, thus allowing staff assigned to call handling to add new tasks to their responsibilities without resulting in additional new workload. On the other hand, if new tasks are added such as video analysis, then additional staff may be required.

9 Training

Education programs should be reviewed as new tasks are incorporated into operations. In addition, training programs should be evaluated to ensure that tasks that are not performed often are able to be performed at the same level as those used routinely.

10 Video

The integration and use of video in handling and processing requests for emergency services is a complex decision point with many implications. As with many of the features and functions of NG9-1-1, video in the ECC does not have to be an “all-or-nothing” decision. It is important that administrators have an understanding of the benefits and potential implications of deploying video in the ECC which may impact staff, especially through phenomena such as vicarious trauma. It is also important for ECC administrators to remember that video may become more common and plan for that possibility. Introducing video into the ECC may be best accomplished through skills-based routing to an analyst or intelligence position who is trained to handle potentially graphic and troubling video. This position may or may not ultimately be within the ECC; each Center will have to decide for itself what is appropriate to its specific operations.

The table below is provided as sample considerations:

¹ The Automated Secure Alarm Protocol (ASAP) is a national service for the processing of information from alarm monitoring stations needing emergency dispatch. (<https://www.apcointl.org/resources/interoperability/asap-to-psap/>)

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NG9-1-1 Concerns	Call Taking	Dispatching	Operations (Supervisors/Shift Leads)	Specialists (Analysts)	Staff (Mgrs./Admin)	On Scene Responders
Legal	Am I now a witness if I view a live video?	Same as Call Taking.	<p>Are the images received real? Is the Chain of Evidence maintained?</p> <p>Is it possible that bad data received could be disseminated?</p>	<p>How do I maintain the chain of Evidence for non-call media?</p> <p>Are there any Records Retention processes?</p> <p>Is there a process to verify authenticity of data?</p> <p>How can I measure if bad data is being disseminated?</p>	<p>Are we in Compliance (Fed / State / Local Regulations)?</p> <p>What is the impact of Video calls on Records Management?</p> <p>Who is liable for a video-based judgement call on dispatch?</p> <p>Who is responsible to verify that a video is authentic?</p> <p>What are the legal issues regarding use/nonuse of video?</p> <p>Will the introduction of Video require a Review of Legislation and statutes?</p>	<p>Can first responders use personal devices to forward video?</p> <p>Can first responders store the data?</p> <p>What are the legal issues regarding use/nonuse of video?</p>
Social Implications	<p>What will be the emotional impact on call takers when graphic video is displayed?</p> <p>Will Citizens expect ECCs to be able to manage all the social media they use?</p>	Same as Call Taking.	Do I have the resources available (CISM, Peer support) to respond to critical events for Telecommunicators?	Is video redaction required or even possible?	What will be the emotional impact on ECC personnel when graphic video is displayed?	Who is responsible for providing third party video (e.g., witness cell phones, surveillance camera feeds, official video)?
Equipment/ Systems (Hardware and Software)	<p>How will Call Takers view video - new screen(s) / Screen allocation?</p> <p>Will Call Takers have the ability to recall, FF, RW, slow media?</p>	Same as Call Taking	Same as Call Taking with supervisory responsibilities for observation of equipment performance.	<p>Are new Server(s) required?</p> <p>Will we require additional FIPPS firewall / CJIS protection from foreign media?</p>	<p>Will we accommodate Real Time remote viewing?</p> <p>What is the Budget impact for additional hardware / software and tools?</p>	Will first responders need transportable media display capability?



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NG9-1-1 Concerns	Call Taking	Dispatching	Operations (Supervisors/Shift Leads)	Specialists (Analysts)	Staff (Mgrs./Admin)	On Scene Responders
	<p>How should Call Takers respond to social media or other nontraditional input?</p> <p>Will video include a re-bid capability?</p> <p>Will it include a multimedia conferencing feature?</p>			<p>Will we have the ability to capture logs and meta data?</p> <p>What are the network Bandwidth considerations?</p> <p>How will we determine when Image Quality is adequate?</p> <p>Will we require Video Redaction capability?</p>	<p>How will we manage the control of stored data?</p> <p>What are the contingency plans that need to be updated to capture new equipment/tasks?</p> <p>Who are the contacts for new systems?</p>	
Process or Procedure	Are new Standard Operating Procedures (SOPs) required to manage video in the ECC?	Are new Standard Operating Procedures required to dispatch based on video in the ECC?	Same as Call Taking with supervisory responsibilities for observation of equipment performance.	<p>Are new SOPs required to address video system availability, access, storage?</p> <p>Is there ability to share video with support agencies?</p>	<p>What Impact will Video have on dispatch times?</p> <p>How will we propagate knowledge of new features and functions to ECC staff?</p> <p>Will the introduction of Video require a review of all existing Policy and procedures?</p> <p>Who is responsible for determining if data is authentic?</p> <p>What are the procedures for questionable data?</p>	<p>What is the Impact on dispatch times?</p> <p>Any requirement to provide video?</p> <p>What are the requirements to receive and utilize video?</p> <p>How will multiple video feeds be handled?</p>
Security	What is the impact of Video on Personally identifiable Information – PII?	Same as Call Taking.	<p>What is the risk of PII in media?</p> <p>Is video in the ECC CJIS Compliant?</p> <p>Will we need more / different control of COMM CTR Visitors?</p>	<p>How is the network isolated? (Border Control Functions, Firewall, DMZ)</p> <p>Who needs to have the rights</p>	<p>How will we manage increased control on Communication Center visitors (CJIS)?</p> <p>How will we protect against what can be seen in the ECC?</p>	<p>Do I have any CJIS responsibility for video transmission and use?</p> <p>How do I determine who has the</p>



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NG9-1-1 Concerns	Call Taking	Dispatching	Operations (Supervisors/Shift Leads)	Specialists (Analysts)	Staff (Mgrs./Admin)	On Scene Responders
				<p>to see and send data?</p> <p>Who is responsible to update data security rights?</p> <p>Will a position be defined to monitor video data?</p>		<p>"need to know" when sending video?</p> <p>Are there any confidentiality requirements with regard to video?</p> <p>Should there be encryption software required on the device?</p> <p>Must we manage how images may be seen from outside of vehicle?</p> <p>Is there any difference in video between handheld devices, tablets, phones, etc.?</p>
Training	<p>Will Call Taking require training on Operations of new systems and equipment?</p> <p>Will Call Taking require training in Data interpretation / analysis?</p> <p>Will I need additional training regarding evidence and testimony?</p> <p>Will this change pre-</p>	<p>Will Dispatching require training on Operations of new systems and equipment?</p> <p>Will this change pre-arrival instructions to responders?</p>	<p>Will System Administration require training on Operations of new systems and equipment?</p> <p>Will functions other than call taking require training in Data interpretation/analysis?</p> <p>Will our current training to recognize stress be sufficient?</p>	<p>Will specialists require training on Operations of new systems and equipment?</p>	<p>What is the impact of training operations and technical staff to accommodate video in the ECC?</p> <p>Will Video require changes in recruitment and hiring criteria?</p>	<p>Will first responders require training on Operations of new systems and equipment?</p>



NG9-1-1 Concerns	Call Taking	Dispatching	Operations (Supervisors/Shift Leads)	Specialists (Analysts)	Staff (Mgrs./Admin)	On Scene Responders
	arrival medical instructions?					
Staffing	Will we require additional call taking resources as the call length and quantity may increase with the addition of video conferencing, multimedia, multi-party video conferencing, and video technology?	Will we require additional dispatching resources as the call length and quantity may increase with the addition of video media?	Will there be a need for a specialized supervisor or will existing supervisors increase their task load?	Will specialists need to be engaged to manage the new media? Can AI be used to assist?		

10.1 Recorded Video

Recorded video or video clips have the potential to provide Telecommunicators and responders with additional information that may reduce confusion or miscommunications. A video of a crime, the ignition of a fire in a structure, or a recording of a medical event all have operational benefits. Accepting recorded video as a standard operational procedure has several impacts which should be considered. Recorded video will often have more impacts after the initial report and delivery to first responders. A method to receive, store, and retrieve the recorded media should be developed.

10.2 Live Streaming Video

Live streaming video has the potential to provide Telecommunicators and responders with additional information that may improve response and responder safety. The ability to have real time intelligence of where a suspect, victim, or patient is and what they are doing can provide true lifesaving information.

As ECCs increase access to video feeds, the possibility of incorporating video feeds when an unusual event occurs could prompt a dispatch prior to or without a 9-1-1 call generated. Technology such as gunshot detection devices activating video cameras in the area and presenting the video to a Telecommunicator or communications analyst may reduce dispatch times and improve response.



ECC administrators should consider that the availability of video will provide additional data which may influence dispatch decisions. For example:

- Visual verification of a reported structure fire that is actually a grass fire.
- Ability to access video when an event is reported such as red-light cameras with license plate readers.
- Stationary public and private video may result in increased incident notifications.

10.3 Video Calls or Video Communications

Consumers are increasingly relying on a variety of real-time video technologies for personal, educational, occupational, and emergency communications. Consumers attempting to make a video 9-1-1 call cannot communicate using video-capable platforms such as Facetime, Skype, Zoom, and other video technologies with another person using a different video platform, including Telecommunicators, due to technical incompatibility. Both parties must utilize same platform to communicate with each other. For this reason, the Federal Communications Commission's (FCC) Wireline Competition Bureau tasked the North American Numbering Council (NANC) with creating an Interoperable Video Calling (IVC) Working Group. The purpose of this North America Numbering Council – Interoperable Video Calling (NANC IVC) Working Group is to explore how to facilitate the provision of interoperable video calling, which could allow increased use of video calling for both hearing individuals and people with hearing and speech disabilities using different, otherwise-incompatible equipment and services. In addition, this is critical for enabling the Next Generation 9-1-1 environment to allow for direct access to emergency services using any video technology that people are familiar with rather than making them utilize a specific video technology that they are not familiar with. NANC IVC submitted its full report preliminary report along with recommendations to the FCC on July 28, 2020.²

There are three categories of video calls that should be considered. The first is via a Video Relay Service (VRS). In this type of call, the user connects to the VRS and then the VRS operator makes an emergency services call to a NG9-1-1 ECC. The second type of call is where the VRS is omitted and the user contacts 9-1-1 directly with a media type denoting video and a media language parameter indicating American Sign Language (ASL). This emergency video session would be routed, most likely using policy routing rules, to a

² <https://docs.fcc.gov/public/attachments/DOC-365871A1.pdf>



Telecommunicator capable of speaking another language beside English. The third type of call would be a generic video call routed directly to the ECC, most likely using policy routing rules that indicated the capability of the ECC.

10.3.1 VRS Facilitated Video Emergency Calls

For emergency calls via VRS, the user would set up a video call, using 9-1-1 as the dialed digits, which is then connected to the VRS provider. The VRS provider would then triage by prioritizing the call, and then ultimately connects the emergency call to the ECC. If the VRS provider has IP connectivity to an ESInet there are three possibilities for the type of call:

1. The VRS connects an emergency call by connecting to the NG9-1-1 ECC by inserting the user location in the call request. In this case, the caller and the Video Sign Language Interpreter would be communicating via sign language and the Video Sign Language Interpreter and the Telecommunicator would be communicating via voice.
2. In theory, the ECC Telecommunicator could video conference in the Video Sign Language Interpreter and the caller. The caller and Video Sign Language Interpreter communicate via ASL and the Video Sign Language Interpreter and the Telecommunicator communicate via video and voice. This method would also allow the call and communication between the Telecommunicator, Video Sign Language Interpreter, and the caller to be monitored and recorded.

10.3.2 Video Emergency Calls to the ECC

For this type of call, when the caller initiates a video 9-1-1 call, it is routed directly to the ECC. In order for the call to be routed to a Telecommunicator capable of doing ASL or to connect to a language service provider that include Video Sign Language Interpreters like any spoken non-English language there would need to be policy routing in either the ESInet or the ECC in order to direct the call appropriately.

10.3.3 Generic Video Emergency Calls to the ECC

For this type of call, the caller initiates a video 9-1-1 call that is routed directly to the ECC. The ECC administrator should consider if a video call should be one way (i.e., only the caller's video is viewable by the Telecommunicator, but the user will not see the Telecommunicator on video) or whether the Telecommunicator should have the ability to open a two-way video conversation. In addition, the ECC administrator should consider if video will be displayed by position or skill level at call answer time or upon request anytime during the call.



11 Telematics

The amount of additional data available through Telematics (i.e., AACN) has the potential to significantly impact Center operations. ECCs will need policies and procedures regarding which telematics data elements are of interest to them and which need to be considered / processed / acted upon as part of the Center's overall incident management workflow. AHJs must establish how Telecommunicators will use this information as they process incoming calls and what additional information they will, in turn, provide to first responders. The ECC can also use the data to take other actions (e.g., if multiple calls from the same location are received) such as providing an automatic message back to vehicle(s) that the ECC has received notification about the incident, including location, and that it is being worked on by Center personnel.

NG technology provides enhanced interoperability and functionality, especially for emergency calls carrying additional data such as vehicle crash data. Enhanced functionality includes the ability for the Telecommunicator to request the vehicle to take an action, such as sending an updated set of data, conveying a message to the occupants, flashing lights, unlocking doors, etc. The capabilities that may be available with AACN are defined within the Vehicle Emergency Data Set (VEDS)³.

AACN includes incident-related information such as airbag deployment, location, and compass orientation of the vehicle, spatial orientation of the vehicle (e.g., upright, on a side, roof, or bumper), sensor data that can indicate the potential severity of the crash and the likelihood of severe injuries, and number of vehicle occupants. In some cases, this may also include audio and video capability.

The ECC should have procedures in place covering the process for understanding and requesting available additional or updated data. Policies and procedures should be developed to address how telematics data will be used to enter, prioritize, and dispatch incidents and Telecommunicators should be provided with training on these procedures so they can use them to make decisions based on data provided. In addition, the potential amount of additional data available may require agency administrators to consider how and by whom this data is requested, analyzed, and acted upon, since many data sets may be too large, and/or contain extraneous data, to be immediately useful.

The automotive industry uses telematics to describe onboard communications services and applications used in cars, trucks, buses, and other vehicles. GPS receivers and telematics

³ <https://www.apcointl.org/resources/telematics/aacnveds/>

devices are installed in each vehicle and generate this data. AACN is enabled by a collection of sensors, GPS, and mobile communications which is used to send information related to an incident, e.g., vehicle crash. The agency administrator will need to identify operational impacts such as proper use of facilities, shared services, and changes in Standard Operational Procedures (SOPs) at the ECC in response to the receipt of AACN data.

Questions to consider:

- Will telematics data be used to determine call priority or as supplemental information?
- Will telematics data be shared with responders and if so, will it be noted as such?

12 Alarms and Sensors

Alarms and Sensors can provide valuable information to assist Telecommunicators and responders. As alarms and sensors become more prolific and sophisticated, they may provide enormous amounts of data that will require machine and human analysis to be of practical use to public safety.

In addition, alarms and sensors may impact staff through vicarious trauma. A law enforcement officer's vest detecting a hit or a sensor reporting that an officer's gun has left the holster will have short and long-term impacts on operations and staff.

Additional examples of the role advanced alarming and sensor technology can play in a NG9-1-1-enabled world include:

- Advanced heat sensors may provide additional information which may be used to enhance dispatch decisions. For example, a call regarding a fire alarm with additional data from one or more sensors that the temperature in the structure is increasing may result in raising the alarm level.
- The use of video sensing to provide data regarding "unusual events" such as a bag being set down and left unattended, or intelligent alarms that may detect crowd movement or unusual noise may impact the ECC by providing advanced notification of an event prior to a call from a person.
- Flow rate sensors that monitor and report on stream, river, and waste may provide real-time approach of limits allowing prior notification and alerting to citizens and responders.

While the deployment of alarms and sensors may assist Telecommunicators, it is critical that Telecommunicators are provided the skills and resources to interpret and act upon the data being provided to make informed decisions.



13 Biometrics

Biometric sensing devices, such as watches or clothing, may provide citizens with faster notification to 9-1-1 as the intelligence imbedded in devices recognizes that a parameter of interest to public safety / first responders has reached a critical level. Given the provisional nature of some of this new technology and the history of inappropriate dialing of 9-1-1 by these devices, communication centers are going to have to work with all constituencies, e.g., the public, service providers, and device manufacturers, to make policy decisions on what biometric information they will use to facilitate emergency response and which it will ignore or discourage until technology is more developed. Also, the transmission, analysis, and utilization of biometric devices worn by either the public or first responders is in its early phases, so communication center managers need to look long and hard at each type of technology proposed for use in their jurisdiction and decide whether they will use this technology “as is” or will wait for it to mature.

14 Text

Real Time Text (RTT) emulates TTY in an IP context and requires an end-to-end IP environment. A RTT call includes a text component and a voice component. When NG9-1-1 ECCs are capable of receiving RTT, they may request that service from the wireless carriers. Since the ECC will receive RTT calls from an ESInet, the SOPs defined supporting the i3 interface would need to be extended to consider RTT communications from the public.

Though today’s communications centers handle interim text conversations (i.e., SMS to 9-1-1), in an NG environment, text will be one of many different data types in the NG9-1-1 world. Therefore, it is important not to lose sight of text in an environment where “voice and text” will not be the only communications media coming into centers. In the recent past, it was considered a significant milestone for emergency communications centers to accept “text to 9-1-1.” In the NG environment, text does not lose its importance, but it is no longer the only alternative to voice. Situating text in its proper place within the multimedia emergency communications center will be important when NG9-1-1 becomes predominant.

15 Location Considerations

NG9-1-1 enables the request and provision of supplemental location data to the ECC. The availability of supplemental location data in the new system creates the potential for multiple sources of caller location to be provided to the ECC. This means that policy- or technology-driven mechanisms should be in place to help agencies to determine which



location(s) should be displayed, so that the number, certainty, and sources of multiple location data are clearly indicated.

A significant change in the NG9-1-1 environment is the delivery of location to the ECC in a new, standardized format. For example, locations will be delivered following a format that requires all elements of the street or location be spelled out – ST becomes STREET, HY becomes HIGHWAY, NE becomes NORTHEAST. Administrators will need to learn the impacts of receiving these differently formatted locations and should research GIS-related Standards for further information.

The agency System Administrator should also understand how multiple locations may be labeled for the Telecommunicator. For example, the device-provided location and the network-provided location may be different regarding degree of accuracy. The agency may choose to provide Telecommunicators only with locations having a certain degree of accuracy or a visual of overlapping confidence based on geo-coordinates. There are a number of methods for displaying this information including colors or highlights. Procedures should be established to assist the Telecommunicator to choose the most appropriate location and to alert responders when a more appropriate location cannot be ascertained from the data provided.

16 Network Roles and Responsibilities

Transition to NG9-1-1 will provide greater control over the public safety network. The 9-1-1 Authority may have jurisdiction over how ESInets and Next Generation 9-1-1 Core Services (NGCS) are planned, deployed, and managed. Some of the networks and services that comprise an ESInet / NGCS may be vendor specific. Others may be purchased as part of a managed service that can provide ESInet / NGCS capability for a monthly service fee.

The network connection between the ECC and an ESInet / NGCS may be a private, public / private, or virtual private network based upon TCP / IP. It will have scalable bandwidth to support new enhanced services. Logical connections between NG9-1-1 and other emergency services or external networks must be strictly managed through appropriate security boundaries. ESInet WANs can utilize leased and / or private IP transport that leverages appropriate network separation, traffic engineering, and security. Inter-working or inter-agency agreements may be required to ensure that the sharing of services can be expected to function as envisioned.

In addition to technical capability, management, and security, the design of ESInets / NGCS must consider factors such as availability, capacity, interconnection, interoperability, and resiliency. Regarding contingency planning, ECC LAN connections to the ESInet must be resilient, secure, physically diverse, and logically separate.



17 Internet of Things (IoT)

The IoT is the interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data. As the IoT expands it will have the potential to impact every aspect of ECC operations, such as the ability to notify an ECC automatically before a human could detect an issue. IoT has the potential to provide additional real-time data to the ECC which can aid in emergency response. System Administrators should understand how these data can be delivered, retrieved, displayed, analyzed, and shared by Telecommunicators.

The amount of data that IoT will potentially make available to ECCs will require some type of automated filtering to analyze and track data to not overwhelm the Telecommunicators. This may include some type of artificial intelligence which can analyze, group, and in some cases respond to the incoming data.

As more devices become interconnected, security will continue to be a consideration. Administrators should develop a comprehensive security plan which includes virus and intrusion protection, at a minimum.

As with all technology, it is important that as this additional data becomes available and as Telecommunicators and responders become more dependent upon it, policies and procedures should be developed to address how and when the data is used and how operations will continue in the event that such data is unavailable.

18 Artificial Intelligence (AI)

The potential influx of data from multiple sources which will need to be received, analyzed, processed, and distributed to the appropriate agencies will require some level of AI in order to process and use it effectively to improve emergency response. In addition to helping make manageable the expected deluge of incoming data from NG9-1-1, AI has the potential to positively impact all aspects of ECC operations. For example, AI can be used to review every step of every call that comes to the center. AI can detect trends that can be used to improve basic and ongoing training. This level of review should be deployed with the full knowledge and understanding of the Telecommunicators and should be used for improvement.

AI should be deployed to support the Telecommunicators' functions, allowing them to focus on citizen and responder safety while AI manages data and provides guidance.

19 Call Handling Functional Element (FE)

The Call Handling Functional Element is concerned with the details of the management of calls. It handles all communications from the caller. It includes the interfaces, devices, and applications utilized by the Telecommunicators to handle the call. It receives and may display the content of multimedia calls such as text and video to the Telecommunicator.

Expected increases in information data types and volume will affect the level of technical, operational, and administrative capabilities of the ECC and the Telecommunicator. The system will introduce new opportunities and challenges such as the need to interact more closely with the Originating Service Providers (OSP). ECCs will have greater control over policy routing rules, both planned and ad hoc, which will provide flexibility as events change. As NG systems are deployed, the impacts on the call handling system will be better understood. ECCs will have options regarding whether to subscribe to hosted services or manage the system internally.

The Call Handling Functional Element will change how requests for emergency assistance are received and additional data are provided. The impact on the Telecommunicator is dependent on what features and functions of NG are deployed. The need for ongoing training to allow Telecommunicators to become proficient as features and functions change should be included in considerations.

20 Data Analytics

As additional data becomes available to Telecommunicators and ECCs, review of these data by a data analytics team separate from the Telecommunicators should be considered so Telecommunicators can focus on the incident. This may be accomplished with trained Communications Analysts using analytics platforms for monitoring video, social media, or other data sources and providing the derived, real-time intelligence to the ECC staff. Regardless of how an agency utilizes analytics, center management should consider if the intelligence will be timely enough to be useful in the ECC, if these actions increase or decrease liability, how the analyzed data can and will be used, if the information can be shared with external agencies, what training is needed, and what regulations impact this function.



21 Information Security

21.1 Personally Identifiable Information (PII), Protected Health Information (PHI) and Confidential Information

Personally Identifiable Information (PII) refers to data that can be used to identify a specific person. Protected Health Information (PHI) refers to Health Care Data that can be used to identify a specific person and their specific medical conditions. As additional data is received and managed at the ECC, administrators should have policies and procedures in place to protect PII and PHI. ECCs currently receive and act upon PII and PHI every day, however NG9-1-1 will increase the volume, type, and methods of PII and PHI that may be presented to the ECC. ECCs should comply with applicable state and federal laws pertaining to the release and management of protected information, such as PII and PHI, and should consult with their legal counsel to ensure compliance with all applicable laws such as the Canadian Personal Information and Electronic Documents Act (PIPEDA) and Personal Health Information Protection Act (PHIPA), HIPAA, CJIS, Record laws, etc.

21.2 Network Security

The NG9-1-1 system must be able to protect confidential information and retain records. NENA released the original NG9-1-1 Security Standards 75-001 (NG-SEC) [ref] in early 2010. The revision NENA STA-040.2-201X [ref] builds upon the new technologies and lessons learned. These standards provide detailed requirements on how to secure NG9-1-1 systems. Agencies have the responsibility to ensure their network security meets current public safety requirements and should therefore not only review and act upon the requirements stipulated in the new NENA standards document (to be released), but should also work to increase their cybersecurity knowledge and solidify their overall security posture.

21.3 Cybersecurity

As ECCs deploy NG9-1-1 functions, new interfaces, and increase their interconnection with other ECCs and support agencies, the need for robust and coordinated cybersecurity will become a priority. This level of interconnection means that a cyberattack or virus introduced into one system could possibly infect all interconnected centers and their associated equipment.

The impacts of cybersecurity include the need for agency level, system level, and service provider level cybersecurity which is layered and coordinated. This should include at the minimum: Access Control, User Management, Host Security, Log management, Session Auditing, Boundary Defense, LAN/WAN management, Network Key Management, Network



Intrusion Detection, Two-Factor authentication, Disaster Recovery, Automated Patch Management, and Transmission Security.

It is also vital that administrators understand that cybersecurity cannot prevent the potential of a successful intrusion. It is therefore critical that ECCs have updated, realistic, and understood Continuity of Operations Plans (COOP). As Telecommunicators become dependent on technology, specific procedures need to be developed to assist when critical functions are compromised. Administrators may consider having pre-recorded announcements for responders and support agencies to maintain critical communications during a cyber event which requires some level of quarantine.

22 Emergency Incident Data Object (EIDO)

The EIDO is a conformant data object used to share emergency incident information between and among authorized entities and systems. An EIDO is created when an agency, e.g. an ECC, needs to send incident information from one agency to another. This will be done during a call when an ECC transfers a call to another ECC, or after the call when incident information needs to be sent to another entity (e.g., call handling system sending incident information to CAD equipment provided by another vendor). An EIDO represents the state of an incident as known by the sender at the time the EIDO was created. Thus, the EIDO is a snapshot in time of data pertaining to an incident. If the receiving agency requires updates regarding the state of the incident, it may subscribe to EIDO updates. For additional information on the use of the EIDO, see NENA-STA-021.1-20YY [ref] (in progress). ECCs need to develop technology and operational standards regarding the processing, handling, and interpretation of EIDO data as this type of information becomes more prevalent with the broader implementation of NG9-1-1.

23 Impacts, Considerations, Abbreviations, Terms, and Definitions

23.1 Operations Impacts Summary

The operational impacts of NG9-1-1 can and should be beneficially transformational; however, these impacts should be well thought out and planned to reduce the adverse impacts that change may have on the operations personnel, management, and communication center technology. NG9-1-1 provides the ability to receive and process data from many sources to more effectively and efficiently dispatch and monitor requests for assistance. NG9-1-1 will allow better situational awareness, interoperability capabilities, and sharing of data among agencies. Without considerable planning, these potentially lifesaving changes could overwhelm the very people and systems NG9-1-1 was developed to assist.



23.2 Technical Impacts Summary

Taking advantage of the NG9-1-1 networks and systems that will enable all of these new features and functions in the ECC will require significant technical enhancements. The impacts of NG9-1-1 are varied and critically important to daily ECC operations. These changes will impact how public safety networks are designed, deployed, monitored, maintained, and administered. AHJs will have more control over the core functions of the networks they use which will require the development of automated processes and procedures to support those systems.

23.3 Security Impacts Summary

As ECCs and the communities they serve become more interconnected, the potential for a security breach becomes more prevalent. Security, in the NG9-1-1 world, requires more than firewalls and patch updates. For the networks and systems to be secure, end-to-end security must be viewed as a critical component and must be given the same resources to succeed as other mission-critical public safety systems. A major impact of security needs will be the ongoing cost to maintain security mechanisms and the potential cost to respond to a security event.

23.4 Recommendation for Additional Development Work

The transition to i3 and NG9-1-1 will continue for many years. As systems are deployed and technology continues to evolve, the lessons learned should be used to refine this and other documents.

23.5 Anticipated Timeline

The transition to NG9-1-1 will continue for many years. Until legacy selective routers are decommissioned and i3 systems are deployed and used exclusively, true NG9-1-1 will not be in place. As systems are deployed the impacts of NG9-1-1 will be better understood; however, a complete picture of the impacts will not be possible until NG9-1-1 is fully deployed in the United States and Canada.

23.6 Cost Factors

Transitioning from legacy E9-1-1 to NG9-1-1 will incur significant costs. Items such as infrastructure, hardware, software, integration, and the cost to train and maintain staff should be considered. Another factor in cost will be what features and functions are deployed and what level of service the ECC is going to provide. New capital and operational costs should be considered to cover specialized NG and cyber-related functions. Economies of scale may be achieved by partnering with state or regional AHJs for ESInet on core services contracts or plans for implementation.



23.7 Cost Recovery Considerations

Normal business practices within the scope of ECCs are assumed to be the cost recovery mechanism for migrating from the legacy E9-1-1 environment to NG9-1-1.

23.8 Additional Impacts (non-cost related)

NG9-1-1 has the potential to impact every part of public safety communications. As NG9-1-1 is being planned, discussions regarding whether agencies should be referred to as ECCs or ERCCs (Emergency Response Coordination Centers) will take place. The need to integrate and coordinate with new solutions such as artificial intelligence, machine learning, Intelligence Centers, and other entities in order to receive, analyze, manage, and act upon additional data for use by telecommunicators and management staff will impact overall operations. How the profession is valued by the public, elected officials, and those in public safety could be impacted. These changes have the potential to impact the nature and functions of agencies, how they are funded, and the rules and regulations that provide guidance.

23.9 Abbreviations, Terms, and Definitions

See NENA Master Glossary of 9-1-1 Terminology, NENA-ADM-000 [1], for a complete listing of terms used in NENA documents. All abbreviations used in this document are listed below, along with any new or updated terms and definitions.

Term or Abbreviation (Expansion)	Definition / Description
Additional Data/Supplemental Data	Data that further describe the nature of how the call was placed, the person(s) associated with the device placing the call, or the location the call was placed from. There are three types of Additional Data: Additional Data for the Call, Additional Data for the Caller and Additional Data for the Location.
Advanced Automatic Crash Notification (AACN)	Beyond basic notification of airbag deployment and GPS satellite-based location of the vehicle, AACN entails the aggregation of in-vehicle crash sensor data to better inform emergency responders prior to their arrival at the accident scene as to the potential severity of the crash and the likelihood of severe injuries to the vehicle’s occupants. AACN information was recently included in the federal guidelines for field triage of injured patients.



Term or Abbreviation (Expansion)	Definition / Description
Artificial Intelligence (AI)	1: a branch of computer science dealing with the simulation of intelligent behavior in computers. 2: the capability of a machine to imitate intelligent human behavior.
Data analytics	Descriptive, diagnostic, predictive, and prescriptive analytics techniques
Emergency Communications Center (ECC)	<p>A facility that is designated by a governmental authority to perform one or more of the following functions:</p> <ul style="list-style-type: none"> • process and analyze 9-1-1 requests for emergency assistance and other gathered information • dispatch appropriate emergency response providers • transfer or exchange 9-1-1 requests for emergency assistance and other gathered information with other Emergency Communications Centers and emergency response providers, • analyze any communications received from emergency response providers, and • perform incident command functions
LAN (Local Area Network)	A transmission network encompassing a limited area, such as a single building or several buildings in close proximity.
Multimedia	The combined use of several media types such as text, graphics, drawings, still and moving images (Video), animation, audio, and any other media where every type of information can be represented, stored, transmitted and processed digitally.
Originating Service Provider (OSP)	A communications provider that allows its users or subscribers to originate 9-1-1 voice or non-voice messages from the public to the 9-1-1 authority.



Term or Abbreviation (Expansion)	Definition / Description
Personal Information and Electronic Documents Act (PIPEDA)	Canadian act to protect personal information
Personally identifiable information (PII)	Information that can be used to uniquely identify, contact, or locate a single person.
Skills-Based Routing	Skills-Based routing (SBR), or Skills-based call routing, is a call-assignment strategy used in call centers to assign incoming calls to the most suitable agent, instead of simply choosing the next available agent. It is an enhancement to the Automatic Call Distributor (ACD) systems found in many call centers.
Standards Development Organization (SDO)	A standards organization, standards body, standards developing organization (SDO), or standards setting organization (SSO) is an organization whose primary activities are developing, coordinating, promulgating, revising, amending, reissuing, interpreting, or otherwise producing technical standards that are intended to address the needs of a group of affected adopters.
Telematics	The mechanisms that support the acquisition of telemetry data and action based upon it.
Vehicular Emergency Data Set (VEDS)	The Vehicular Emergency Data Set (VEDS) provides useful and critical data elements and the schema set needed to facilitate an efficient emergency response to vehicular emergency incidents. The VEDS uses the Extensible Markup Language (XML) open standard and conforms to the National Information Exchange Model (NIEM) as a common data exchange format to provide a consistent method of data exchange.



24 Recommended Reading and References

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ACKNOWLEDGEMENTS

The National Emergency Number Association (NENA) PSAP Logistics Committee, NG9-1-1 Impacts on the PSAP developed this document.

NENA Board of Directors Approval Date: 12/17/2021

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Special Acknowledgements:

Delaine Arnold, ENP, Committee Resource Manager, has facilitated the production of this document through the prescribed approval process.

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