SOLACOM

MOVING TO STATEWIDE NG9-1-1:

ARCHITECTURE, SOLUTION, AND PLANNING CONSIDERATIONS FOR PSAPS

A Solacom White Paper

Migrating to a Next Generation 9-1-1 (NG9-1-1) emergency call handling and management system is not optional for public safety answering points (PSAPs). PSAPs and the systems they use need to keep pace with the people they serve. And PSAPs need better ability to cooperate and collaborate with a range of first response teams, agencies, and centers across a broad geographic territory.

The legacy Enhanced 9-1-1 (E9-1-1) systems that many PSAPs still use don't provide the flexibility or speed needed to effectively serve people and interoperate with other teams. These systems rely on narrowband, circuit-switched networks that were designed for land-lines and voice-only communications. They provide very limited data capabilities and often include proprietary or closed elements that limit information sharing.

Today, many people communicate using smartphones and short message service (SMS) text messages. And it's not just teenagers and young adults who prefer these communications methods. The deaf and hard of hearing are increasingly using SMS rather than teletypewriting devices for the deaf (TDDs/TTYs) to communicate. In addition, people of all ages share enriched data, such as photos and videos, without stopping to consider whether the receiving party can support the format. It's just expected.

Legacy Enhanced 9-1-1 systems don't provide the flexibility or speed needed to effectively manage today's emergency calls.
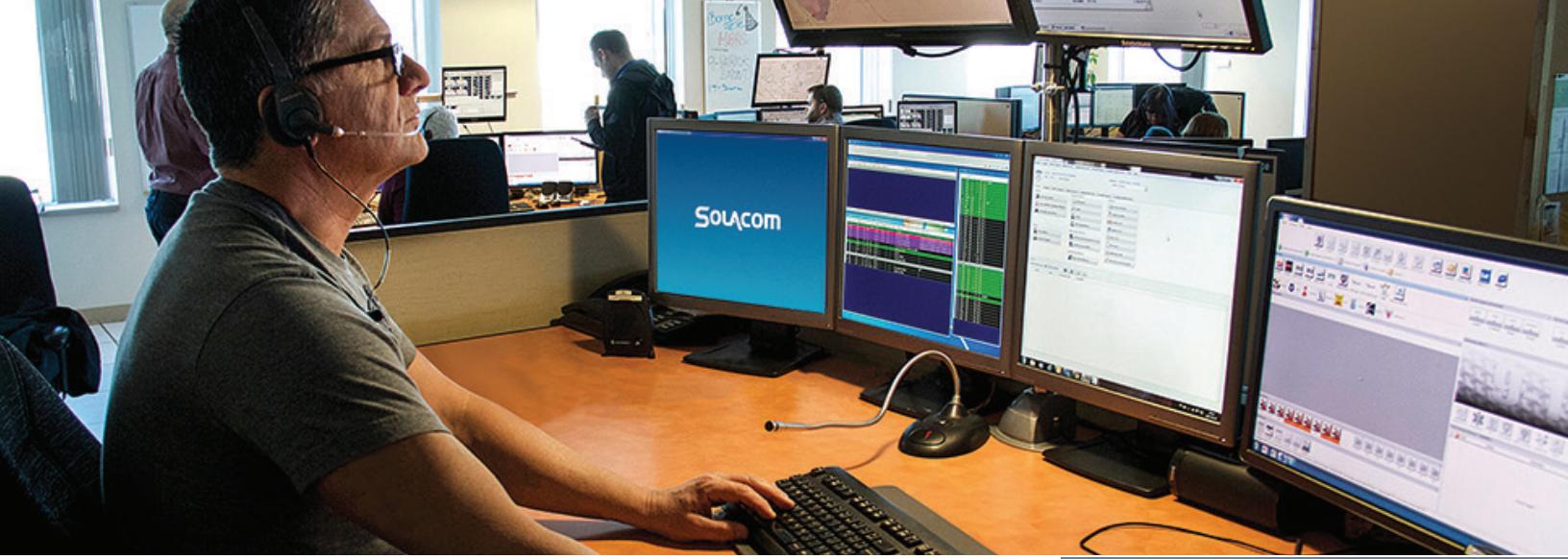
To do their job effectively, call takers need the ability to deal with text, photos, and video. They need access to supporting information, such as precise location, medical information, telematics data, and building plans. And they need the ability to seamlessly access and transfer all of this data across county, state, and international borders, as well as across any number of centers and agencies.

Planning and implementing an NG9-1-1 solution can seem daunting. It's a fundamental shift in emergency communications services that is on the same order of magnitude as the introduction of Basic 9-1-1 services. But it's a shift that's necessary. Simply adding improvements, such as those that have taken services from Basic 9-1-1 to E9-1-1 and Cellular 9-1-1, is no longer adequate.

With the right approach to migration, and the right supporting technologies, PSAPs can move to an NG9-1-1 system over time while managing risks and costs. This paper describes key considerations and options for PSAPs looking to evolve towards statewide NG9-1-1. It explains why PSAPs should:

- Adopt an open, standards-based system architecture that supports today's needs and tomorrow's goals
- Choose a complete call management and handling solution that enables flexible, user-centric communications
- Develop a comprehensive migration plan that considers infrastructure, staff training and organizational changes, and system monitoring
- Partner with a dedicated NG9-1-1 specialist who can help to mitigate risks and optimize costs before, during, and after migration

> Call takers need the ability to seamlessly access and transfer text, photos, and video across agencies, as well as county, state, and international borders.

Adopt an Open, Standards-Based Architecture

An open, standards-based system architecture lets PSAPs meet shorter-term goals for improving service delivery while leaving the door open to a longer-term migration plan. It also helps PSAPs prepare to support new end user communications capabilities, technologies, and devices when they become available.

The NENA NG9-1-1 architecture standard, Detailed Functional and Interface Standards for the NENA i3 Solution (commonly known as i3), is the universally acknowledged basis for public safety deployments of NG9-1-1 systems. It is designed to meet the requirements in the draft Next Generation 9-1-1 Act of 2017, which calls for an "accredited, non-proprietary, consensus-based standards approach for all aspects of NG9-1-1 services."

The i3 standard describes protocols, interfaces, and systems to locate users who contact 9-1-1 using voice, video, text, data, and other means. It also describes the system capabilities and components required to route communications to the appropriate PSAP and to allow for easy transfers, failovers, and multi-party calls.

9-1-1 authorities and private-sector companies see i3 as the standard for NG9-1-1. The public safety industry is producing products and services based on the i3 standard. Canada has adopted i3 as the NG9-1-1 standard, and i3 has been used as the basis for Europe's NG1-1-2 standard. Across the country, PSAPs are issuing RFPs for i3-compliant NG9-1-1 solutions. And early adopters, such as the state of Maine, are already using an NG9-1-1 system that is based on the i3 standard.

With the widespread adoption of i3 as the NG9-1-1 standard, PSAPs that embrace the standard as they migrate are in a much better position to improve their own operations and to interoperate with other agencies and authorities.

Plan for Today and Tomorrow

As PSAPs evaluate their system architecture requirements, they should keep in mind that the system needs to be engineered to support NG9-1-1 requirements today and to enable future enhancements without replacing the underlying infrastructure. With that in mind, there are a number of architecture and design

> PSAPs that embrace the i3 standard are in a much better position to improve their own operations and to interoperate with other agencies and authorities.

imperatives that PSAPs should carefully consider when moving to an NG9-1-1 system, especially if they are looking to scale the system to deliver NG9-1-1 services statewide.

To maintain 99.999% system availability, the NG9-1-1 architecture must be based on highly reliable subsystems, hardware and software, geo-diverse core network elements, and a plan for backing up PSAP communications.

The core data center capabilities that control the service — routing policies, network and legacy system interfaces, and Automatic Location Identification (ALI) — must be built so that the architecture provides redundancy across a broad geographical region.

Achieving these capabilities typically requires equipping two data centers with redundant components and placing them with independent Legacy Network Gateways (LNGs) and Session Border Controllers (SBCs) at each site (Figure 1).

As shown in Figure 1, the terminating Emergency Services Routing Proxy (ESRP) platforms are located at two sites and are diversely related to each other:
  • ESRP platform 1, side A is at site 1 with ESRP platform 2, side B.
 • ESRP platform 2, side B is at site 2 with ESRP platform 2, side A.
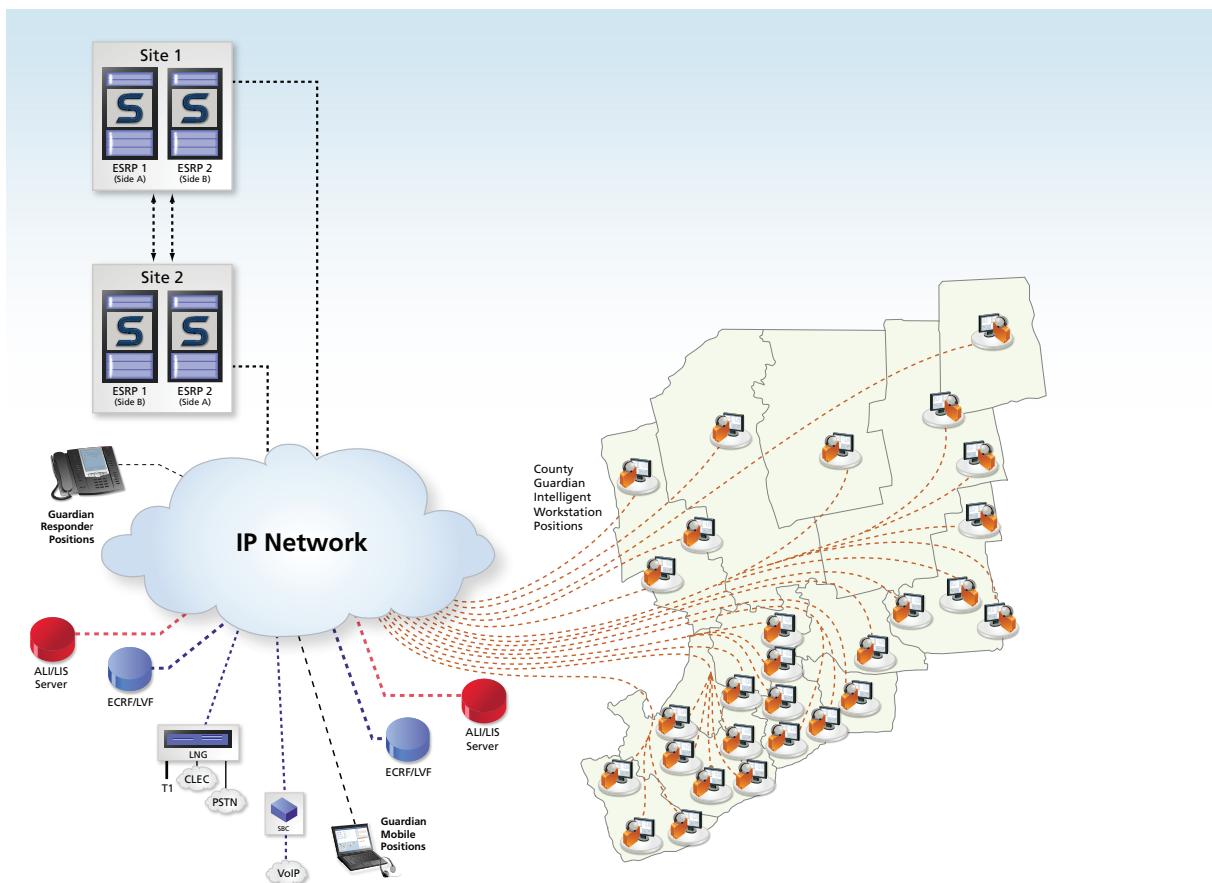
Figure 1: Example architecture for a statewide NG9-1-1 implementation.

Every call taker workstation at every PSAP is connected to both sites with one ESRP as the primary routing proxy and the other as secondary. The Emergency Communications Routing Function (ECRF) servers are deployed in a similar geo-diverse arrangement in each data center. This architecture provides full geo-diverse redundancy for ongoing services, and enables upgrades and changes to be made without system downtime.

Components within the architecture are integrated to work together on any given 9-1-1 call:

- LNGs and SBCs provide the access points for callers coming in on different types of trunks — CAMA, SIP, and SS7. These major subsystems provide the protocol version and, most importantly, the security to bring callers onto the Emergency Services IP Network (ESInet), which is the backbone of the overall service.

- ECRF servers and the ESRP work with the ALI database to route wireline and wireless calls to the right PSAP.

The connectivity between PSAPs will likely require connections to different service providers because every location will not have fiber available all the way to the PSAP. This requires careful selection of network equipment, configuration, testing, documentation, and troubleshooting.

In addition, great pains must be taken to ensure that no call is lost across the service area. Each PSAP needs a backup option in case it becomes inoperable for any reason. There is considerable flexibility for setting up backup routing in the ESRP, but every migration plan should include a backup plan for the initial PSAP cutover, as well as a long-term backup plan as the migration progresses. Backup routing must be thoroughly tested to ensure that it is correctly provisioned for all PSAPs after the PSAP is cut over.

Additional architectural requirements will depend on the call handling and management solutions that the PSAP will deploy in the short term, as well as longer-term plans to evolve to a full NG9-1-1 solution.
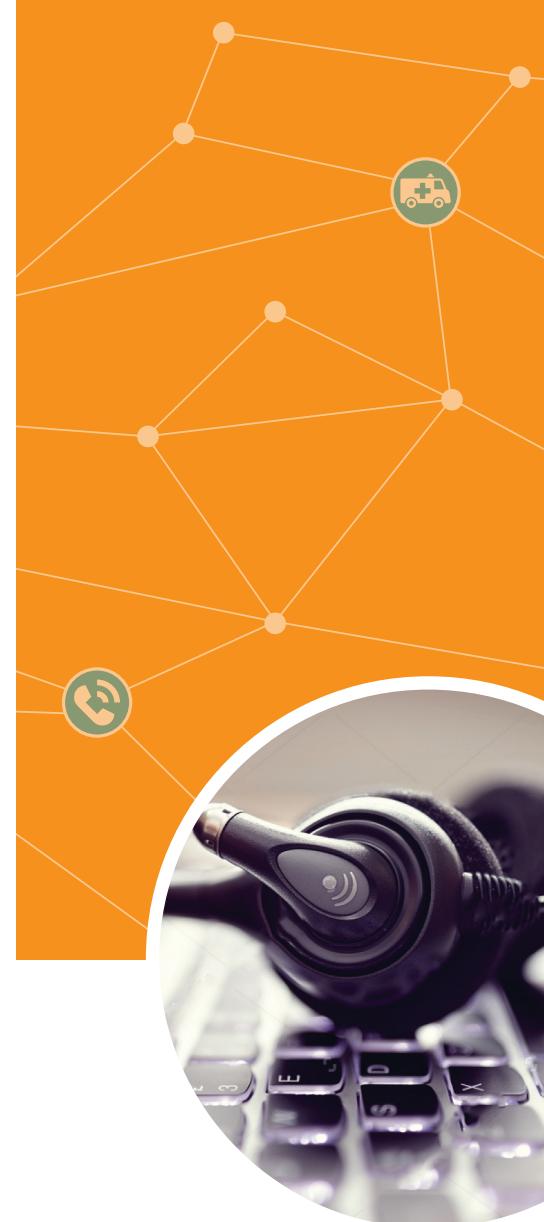
Choose Solutions That Enable Flexible, User-Centric Communications

Call handling and management solutions that enable flexible, user-centric communications simplify the call management process and enable faster analysis, evaluation, and forwarding of all emergency calls, regardless of how they are placed. With a complete solution, PSAPs have everything they need to support interactive voice, data, and video communications between PSAPs and callers. They also gain sophisticated mapping, intelligent call rollover, and call transfer capabilities.

A complete solution should provide supervisors with detailed call logs and statistical data they need to accurately evaluate and customize system settings. For example, they can use the data to see how many calls came into their PSAP, how many rolled over to other PSAPs, and can adjust call routing settings to better handle incoming call volumes and types.

The ability to seamlessly share important information — not just voice calls — with other agencies is also an important requirement. For example, the state of Maine has been able to successfully test the sharing of location data with the U.S. Coast Guard — an agency that falls outside of regular fire, police, and rescue operations. This information sharing ability can also be used for dispatch as more and more boaters abandon their marine radios in favor of cell phones to call 9-1-1 for help.

Similarly, selective transfer routing capabilities allow call takers to transfer calls to other agencies without needing to know the dispatch point. They simply click the button for that agency and the wireline or wireless call is automatically transferred, along with any associated information, to the right center for dispatch. With integrated geo-location and mapping capabilities, call takers can quickly determine the most appropriate agency for the call.

Most importantly, solutions that use IP for communications rather than legacy trunk services enable call takers to communicate more effectively. Consider text calls as an example. Today, the location of text messages is typically based on the location of the cell tower, not where the person texting is located. This means that the person texting a PSAP may actually be better served by a different PSAP.

Call handling and management solutions that enable flexible, user-centric communications simplify the call management process.

With IP communications, call takers can easily transfer an entire text conversation to a more appropriate PSAP. They can also take advantage of text-to-911 and text-from-911 capabilities. They can use pre-scripted text messages for faster responses. And they can use text to reconnect with disconnected or abandoned callers.

Put Call Takers in a Better Position

Call takers are the crucial link between people who need assistance and the agencies that can provide that assistance. With NG9-1-1 solutions that are based on human-centered design (HCD) principles, call takers are in a better position to quickly and effectively deal with incoming communications. At the same time, PSAP managers are in a better position to optimize workflow.

Solutions based on HCD principles are designed with comfortable ergonomics, provide an intuitive user interface, and include tools that make call processing more efficient. They give call takers the flexibility to work in the way that is best for their individual needs.

When evaluating call handling and management solutions, PSAPs should look for solutions that offer a standardized configuration and user interface that can then be customized to fit individual preferences. PSAPs may want to base standard configurations on a set of predetermined functions, or they may want a single standard configuration for all call taker positions. Key user interface features to look for include:

- Customizable icons and buttons
- Buttons sized for touch screen operation
- Mute, privacy, and hold buttons
- Buttons sized for call takers with visual disabilities
- Intelligent transfer buttons that allow call takers to select the type of outgoing call based on the type of incoming call
- Multimedia interfaces for non-voice communications, such as text-to-911, instant messaging, and TDD/TTY
- Text-from-911 capabilities that allow call takers to initiate text conversations

Look for solutions that offer a standardized configuration and user interface that can be customized to fit individual preferences.

Develop a Comprehensive Migration Plan

Migrating from E9-1-1 to NG9-1-1 affects all aspects of PSAP operations. Regardless of which architectural approach being considered and which call handling and management solutions are selected, PSAPs need a carefully thought-out migration plan to prepare for the transition.

The first priority is to ensure that the organizational structure can support the new services. With many legacy core network platforms being replaced, IT staff will need to be trained in how to configure, test, and maintain new equipment. They'll also need to support central office personnel as they learn the new systems.

Large-scale migrations, such as those that are intended to deliver statewide NG9-1-1 services, will also affect the field service technicians at the 9-1-1 provider. For example, moving to more centralized cloud-based control of user configuration and administration shifts configuration and administration responsibility from the local PSAP to the data center. This evolution typically requires changes in overall job descriptions, as well as new procedures for moves, adds, and changes.

Invest in Lab and Training Facilities

Including a lab site and a training facility in the migration plan allows PSAPs and their partners to start testing equipment and systems and to start training technical staff early in the migration process. Labs and training facilities should be configured as similarly as possible to the actual system being deployed. This helps to ensure full testing of all scenarios, including inter-PSAP calls and failover scenarios.

System tests should include:
- Component testing of the major subsystems
- Integration testing of the network core
- Call flow testing across the network core
- Integration testing of the ESInet with the Layer 2 network

Tests at the PSAP location should include:
- Local network testing
- Equipment testing
- Call flow testing
- Backup system testing

A carefully thought-out migration plan will enable a smooth transition.

- Integration and interoperability testing with on-site systems, such as computer-aided dispatch (CAD) and recording systems

Investments in labs and training facilities also give PSAPs a realistic environment for training call takers to use new systems and technologies. To encourage knowledge retention, call taker training should be delivered as close to the transition date as possible.

With careful planning, labs and training facilities can continue to provide value to the PSAP over the long term; they can be used for testing and training purposes before system upgrades or when new equipment is about to be deployed.

Look Beyond Deployment

A comprehensive migration plan should also consider how post-deployment monitoring and maintenance services for the NG9-1-1 system will be delivered. Ideally, technicians should be automatically notified of any issues in the system, and backup systems should automatically take over when needed. To enable this level of ongoing support, performance indicators, alarm levels, and ticketing procedures for various scenarios all need to be defined.

Partner With a Specialist Who Is Dedicated to NG9-1-1

Migrating to an NG9-1-1 system is a complex undertaking that requires complete understanding of every aspect of emergency services provisioning — from design, configuration, implementation, training, and organizational responsibilities to maintenance and support. With all of the various technologies and processes that must be considered, PSAPs will need guidance and assistance from a dedicated NG9-1-1 specialist.

An NG9-1-1 specialist who is dedicated to NG9-1-1 is in the best position to help PSAPs evaluate their short- and long-term requirements in detail and migrate to an NG9-1-1 system over time with lower risks and costs.

Unlike other providers whose emergency management solutions are a sideline business, Solacom focuses exclusively on public safety communications management. Our emergency call management solutions are specifically designed to meet the unique needs of

A comprehensive migration plan should consider how post-deployment monitoring and maintenance services will be delivered.

PSAPs at all stages of the process — from initial design through procurement, deployment, and ongoing support. They are built on more than 30 years of research and innovation and support thousands of agencies affecting millions of lives annually.

Migrate With Confidence

Solacom solutions enable smooth integration of new technologies and capabilities over time. PSAPs choose the hardware, software, features, and functions they need, when they need them. They don't have to replace legacy equipment, interrupt workflows, or disrupt work environments. Instead, they have customizable, interoperable solutions that help them:

- Protect past investments
- Streamline the migration to NG9-1-1
- Simplify future upgrades
- Lower total cost of ownership

With Solacom solutions, PSAPs have all of the capabilities they need to deliver statewide NG9-1-1 services with the highest levels of reliability and security:

- **Faster and easier call handling** capabilities that are based on a single communications workflow for new and legacy technologies and for all types of communications.
- **More accurate call routing** capabilities regardless of the network access used by the caller.
- **Integrated text-to-911 and text-from-911** capabilities so call takers can handle text-based calls and reconnect with disconnected or abandoned callers using text.
- **Accurate location** capabilities so call takers can select the most appropriate agency for call transfers.
- **Complete call logging, tracking, and reporting** capabilities.
- **System monitoring** capabilities that detect issues within the system and initiate corrections within 15 minutes of detection.

All Solacom solutions are backed by an experienced team that has successfully deployed emergency call management solutions worldwide — from standard two-position PSAPs to complex, statewide, and even continent-wide NG9-1-1 public safety networks.

With Solacom as their partner, PSAPs can rely on the experience and expertise of a dedicated NG9-1-1 system provider and a proven industry innovator.

Solacom Is an Industry Leader

Solacom actively works with industry associations and working groups to define and deliver standards for effective and efficient emergency call management. We have delivered numerous industry firsts, including:

- First Geospatial Router in operation (pre-NENA specification) – 2007 for enterprise 9-1-1 traffic
- First demonstration of USDOT proof of concept at NENA 2009
- First national deployment that replaced DMS-100 tandems for 9-1-1 selective routing
- First national deployment using direct IP connectivity from a Local Exchange Carrier (LEC) — Kentucky
- First fully IP-hosted customer premise equipment (CPE) ESInet — Indiana
- First NENA certified NG9-1-1 — Illinois
- First statewide NG9-1-1 system — Maine

Acronyms

ALI	Automatic Location Identification
CAD	Computer-Aided Dispatch
CPE	Customer Premise Equipment
E9-1-1	Enhanced 9-1-1
ECRF	Emergency Communications Routing Function
ESInet	Emergency Services IP Network
ESRP	Emergency Services Routing Proxy
HCD	Human-Centered Design
LEC	Local Exchange Carrier
LNG	Legacy Network Gateway
NG9-1-1	Next Generation 9-1-1
PSAP	Public Safety Answering Point
SBC	Session Border Controller
SMS	Short Message Service
TDD/TTY	Teletypewriting Device for the Deaf/Teletypewriter

Additional Information

<u>Click here</u> for more information about how Solacom can help you make the move to flexible, user-centric 9-1-1 call handling and management in your PSAP.

Contact Us

Solacom 9-1-1 call handling and management solutions are built on more than 30 years of research and innovation in the application of advanced hardware and software technologies for public safety. Today, Solacom Guardian 9-1-1 solutions support thousands of agencies affecting millions of lives annually — from dense urban environments to statewide deployments.

Contact us today to discover how our Guardian solutions can help your PSAP streamline 9-1-1 call handling and management processes and enable more efficient collection of critical information in emergency situations.

Visit our website: www.solacom.com

SOLACOM

A Subsidiary of
Comtech Telecommunications Corp.