NPSTC Report
Radio Interoperability Best Practices

January 2017

The National Public Safety Telecommunications Council is a federation of organizations whose mission is to improve public safety communications and interoperability through collaborative leadership.

TABLE OF CONTENTS

Executive Summary

Several major incidents in the U.S., including the death of 19 wildland firefighters in the State of Arizona and the Washington D.C. area Navy Yard shooting, have focused attention on the need to define essential radio interoperability best practices involving daily operational use, system support and device programming, interoperability system management and access, and training.

NPSTC was requested to develop a set of communications interoperability best practices. The Radio Interoperability Best Practices Working Group (RIOBP), under the Interoperability Committee, has developed several initial best practice statements using a standard template to record each. The template records the best practice statement, a statement of importance, supporting elements, use cases, a migration path to meet the best

practice, and how each relates to the SAFECOM Interoperability Continuum with regard to Standard Operating Procedures, Governance, Technology, Training/Exercise, and Usage.

The group was formed on May 29, 2014. There are currently 136 members in the group that have asked to participate and review information as it is submitted and approved. The Working Group is chaired by Mark Schroeder, Communications and Infrastructure Manager, City of Phoenix who submitted the original request for Working Group consideration to the NPSTC Governing Board.

The Working Group utilized the recommendations and information contained in after action and incident reports that noted specific areas for improvement, and agency or regional operating procedures which were submitted for review to determine if strategic level best practices could be defined and recommended for buildout into a Best Practice Statement.

In many of the reports reviewed, common issues were identified that can be mitigated beginning at a strategic level. The Best Practices are designed for adoption by individual agencies and organizations at a strategic level.

It is important to note that these are Best Practice recommendations and are not intended to be standards or requirements. We fully realize that not all agencies operate the same and some will not be able or inclined to follow them to the letter. We have chosen to express what we believe is the highest goal, with the understanding that any step forward in the migration path is an improvement.

Technology changes rapidly and is expected to do so exponentially faster in the future. Because of this, the Best Practice Statements will avoid technical content when possible. To extend the longevity of the reference information used in developing these Best Practices, the report will point to the location where supporting references can be found rather than post them directly to the report.

The Working Group identified 13 topics as their original scope of work. The Best Practices currently in production and the best practice statement explaining their intent are listed below.

Nationwide I/O Channel Naming and Usage
Nationwide Radio Interoperability Channels should be used with the ANSI Standard 2017 designated names, frequencies, and technical information; and in accordance with the FCC and NTIA designated usage for that channel.

Radio Channel Assignment and Use Within High-Risk Incident Environments
When an emergency service worker is deployed into an environment that could increase the risk of safety to themselves or others, the radio communications equipment that is provided and used by that worker should be programmed and verified to have all channels that are to be used by that worker's assignment, in that environment, having the same channel position, name, and technical specifications identified for that incident.

Documenting the Use of Interoperability Channels
The use and availability of all National I/O Channels by an agency should be recorded on an appropriate Incident Command System (ICS) form, submitted to the state or regional authority, for uploading and management in a nationwide database.

Interoperability Systems Change Management Practices
Change management practices and policies should always be used to ensure that any changes to operational policies, system modifications, additions, or deletions of interoperability system infrastructure are communicated to all affected agencies.

Deployment for Interoperability Resources

Time Phased Deployment relates to the need to call for certain resources early in an incident which will take time to respond to the scene and be activated. For example, mobile command vehicles and deployable communications infrastructure need to be activated early in an incident if it is to be available when needed.

Infrastructure Management

Infrastructure management best practices will address readiness, resiliency, and availability of I/O systems, including regional coordination of infrastructure design and implementation.

Radio Device Management: Readiness, Resiliency, and Availability

Subscriber management best practices will address readiness, resiliency, and availability of mobile and portable devices, including radio caches and dispatch consoles.

Channel Assignment Based on Infrastructure Coverage

Incidents should be assigned to channels based on infrastructure coverage.

Communications Span of Control

There should be a ratio of one person to one talk path for "critical incident communications" between the Incident Commander and first responders in the "hot zone" during situations which involve immediate threat to life and safety (known as IDLH in the fire service but applicable to law enforcement activities).

Training and Proficiency in the Management and Usage of I/O Systems

Radio Interoperability (I/O) equipment and systems should be used and managed only by personnel who have been properly trained and who have demonstrated proficiency with the appropriate technical, operational, and procedural aspects. This Best Practice applies to technicians, responders, dispatchers, and managers, and includes both operational and interoperability issues.

After Action Reviews

When I/O resources are used to support a multi-agency incident, an after action review (AAR) should be completed including both operational and technical components.

Interoperability Relationships

Formal relationships should be created to govern and manage interoperability resources.

Managing Encryption during Interoperable Events

The use of a nationally recognized coordination organization and a secure database management system should always be used to obtain and register encryption attributes of systems or channels that are supporting interoperability between agencies.

Updated information about the status of each of the above Best Practice candidates, including supporting documents and reports is available on the NPSTC website.

1. Overview of Issue

1.1 Development of Standards by Partnering Organizations

For many years, various organizations and agencies have recognized a need to develop reference points or measurements to duplicate success or avoid communication failure. These have typically resulted in the development and publication of technical standards. The technical standards are measurable and repeatable when following the technical parameters.

Technical standards are then recognized or adopted by an organization or others with similar needs. These standards are submitted for national registration through established processes. In some cases, they are then managed and updated by the sponsoring organizations or deleted as technology improvements are made and a new standard is identified.

1.2 The Necessity of Best Practices

Technical standards establish specifications and procedures designed to ensure the reliability of the materials, products, methods, and/or services necessary for reliable public safety communications but are ineffective without the support of policies and procedures recommending their use. From the public safety users' standpoint, standards are extremely important because they allow the combination of devices from different manufacturers to be used together to enable interoperability. To this goal, public safety agencies should always select communications equipment that complies with published standards.

Organizations like NPSTC play a key role in advocating the use of standards that promote effective interoperability. A Best Practice Statement identifies why a technical standard is important.

Best practices are needed to help improve operational activities of a typical public safety organization. Technical standards are essentially confirmed as being "public safety grade" when reviewed and supported by a best practice.

1.3 Best Practices Form the Base for Strategic Objective Development

Best practices are simply a statement defining a strategic goal. They are not intended to be measurable, but are intended to provide a factual position that should be considered.

1.4 Purpose of a Best Practice

The National Public Safety Telecommunications Council is a federation of public safety organizations whose mission is to improve public safety communications and interoperability through collaborative leadership.

NPSTC has been very active in creating recommendations and providing support for the development of public safety requirements. These NPSTC Radio Interoperability Best Practice Recommendations are designed to provide guidance to Public Safety agencies and organizations regarding safe and efficient use of interoperability resources.

Each Best Practice will include a narrative about the purpose of the Practice, a basic progressive approach in which this Practice can be achieved, and a case study or approach that supports how the Practice can lead to effective interoperability.

1.5 Identifying a Best Practice

There are many agencies and organizations that have already established optimal procedures for communications and interoperability. Best practices are generally defined or submitted by an experienced official who has had practical experience in issues related to communication systems or their use by operational members.

1.6 Best Practices Enhance and Promote Standards

Standards are always intended to be measurable. When a standard is created it is based on a measureable quantity of some type that describes a very specific configuration, action, or result. Standards are developed, tested, and documented based on a defined strategic goal. Standards are then adjusted over time as the technology and measurements become better. But, a strategic goal rarely changes. Strategic goals and technical standards are always best communicated together in the form of a best practice. The goal of a Best Practice is to show why and how a specific standard or a group of standards should be used to help improve common issues.

1.7 Successful Elements/Common Failures

These Best Practices are intended to highlight and define the successful elements commonly found during public safety incidents. At the same time, common failures are reviewed to determine a migration path toward improvement. Working Group members leveraged their operational and technical expertise in the review of the submitted reference materials in order to establish the Best Practice Statement.

1.8 Multiple Best Practices Can Be Contrasted against a Single Incident

A single Best Practice is not intended to resolve all issues that arise in a single incident. Both incident and after action reports will often detect multiple areas for improvement and identify recommendations for correction. NPSTC Best Practices are intended to address single common

issues and, when used in combination, provide guidance into addressing many common interoperability issues.

2. Development of a Process to Create Best Practices

2.1 Historical Development /Discussions
In its early stages, members of the group solicited feedback and received nearly 200 suggestions for development into Best Practice statements. During a face-to-face meeting, that list was placed into categories which became the basis for the first 12 Best Practices to be developed. An initial work plan and format was established, but in the course of its discussions, the group revised both the work plan and the format to develop an effective vehicle which would work across the broad span of topics to be covered, as well as adding to the original list of Best Practices as the need arose.

2.2 Identification of a Best Practice for Consideration
A Best Practice is submitted for consideration by anyone who has practical experience or knowledge that could help improve public safety interoperability.

2.3 Identifying Key elements to Build and Support a Best Practice
When a Best Practice is submitted, it is important to provide case studies, examples, policies, or any other information that could help in building a document for consideration.

2.4 Best Practice Statement
This statement is specific, at a high level, and should not be directive using "shall," "must," or other terms traditionally associated with a requirement. It is visionary in its construction and not a measurable standard. But it can reinforce the need to follow a specific standard or standards.

For example: There are several technical standards that define either how radio channels should be named and specifically programmed into a radio/console or how to build out radio sites. These Best Practice Statements would identify their use as a Best Practice.

2.5 Statement of Importance
The statement of importance makes a case as to why a Best Practice should be executed by an organization or an agency. The statement also provides a more detailed narrative that may identify common problems to help support how the Best Practice can mitigate problems. This statement can also reference a practice that is not well known or defined. This is normally accomplished through discussions following an incident or incidents that have a common recurring issue that can be solved by defining a Best Practice.

2.6 Supporting Elements

In this section, specific roles would be defined to assure that a Best Practice is implemented and managed. These roles can either be specific to a typical agency structure or are roles that are to be assigned. Supporting elements may also be presented that point to established processes or existing standards to help construct policies and processes that support the best practice. For example, the ANSI interoperability channel naming standard would be referenced as a best practice when building policies and programming templates.

Best practices are created to help promote technical standard applications and guidance, encouraging agencies and organizations to establish detailed processes, policies, or operational requirements.

2.7 Use Case Examples

Use Cases are described in a narrative that demonstrates how the application of the best practice provides effective interoperability. The cases presented generally do not show a negative outcome when a best practice is not followed. There are too many potential failure scenarios that can be described. It is beneficial to show positive outcomes based on the application of the best practice.

The case or cases do not always show all supporting elements described above, but are written to demonstrate the most relevant.

For the purpose of these Best Practices, we have used standard Incident Command System (ICS) roles and terminology, recognizing that different agencies have often used their own nomenclature for those roles. The use case will focus on the functions performed by the role and not on the agency designated title.

2.8 Migration Path

This section shows how a best practice can be achieved by taking current operational processes and transitioning them to the best practice. A common tool that is used is the SAFECOM Interoperability Continuum. This shows how many processes and practices can be matured to reach the highest levels of interoperability.

Each best practice will describe a common method by which basic interoperability can be matured to the type of interoperability described in the best practice.

### 2.9 Related Documents and Location

This is a reference area for this Best Practice. It may include local documents stored on the NPSTC website, an Internet link to a site where information is maintained, or a published agency policy. If another link is not available, the reference documents will be available on the Best Practice Working Group page of the NPSTC website – *www.NPSTC.org*.

2.10   Relationship to SAFECOM Interoperability Continuum

Developed with practitioner input by the Department of Homeland Security's SAFECOM program, the Interoperability Continuum is designed to assist emergency response agencies and policymakers to plan and implement interoperability solutions for data and voice communications. This tool identifies five critical success elements that must be addressed to achieve a sophisticated interoperability solution: governance, standard operating procedures (SOPs), technology, training and exercises, and usage of interoperable communications. Jurisdictions across the nation can use the Interoperability Continuum to track progress in strengthening interoperable communications[1].

This section identifies which lanes of the Continuum are touched within each best practice.
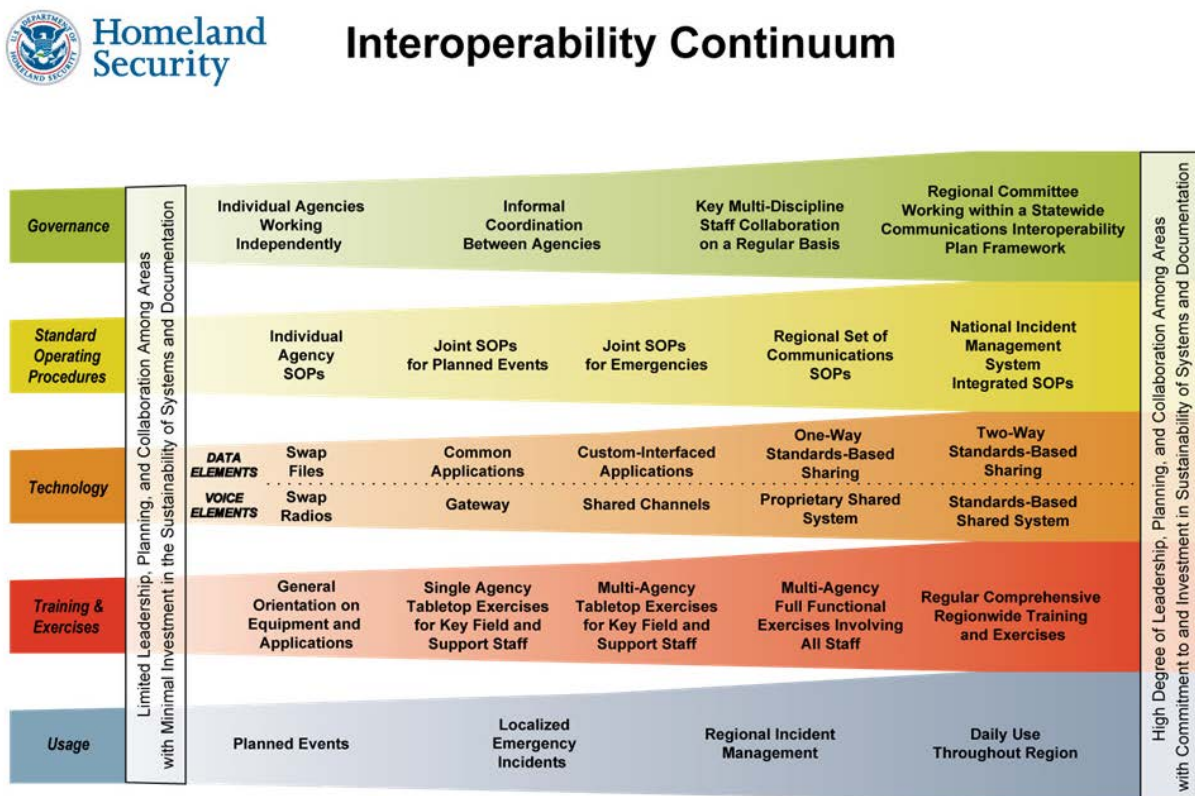
Governance: A major part of the success of each best practice is governance. Interoperability succeeds when governance is established and practiced in advance of any incidents. Governance is noted when language that is constructive to building governance around a best

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[1] https://www.dhs.gov/sites/default/files/publications/interoperability_continuum_brochure_2.pdf

NPSTC Radio Interoperability Best Practices Report, January 2017

practice or how a best practice would best be implemented using a governance agreement is mentioned.

Standard Operating Procedures: A standard operating procedure, or SOP, is a crucial component to the success of nearly all of the best practices. A complete and concise SOP is the first step in achieving efficiency, quality output, and uniformity of performance, while reducing miscommunication and ensuring essential and critical components of the best practice are not missed. Standard operating procedure is noted when variations of existing or template SOP language that can be used to support the best practice are referenced.

Technology: Technology plays a vital role in achieving interoperability; however, without the support of the either four lanes of the continuum it is simply a box on a shelf. Technology is reserved to describe any or all of the known technical settings or technologies that are typically used to meet the intent of the best practice.

Training / Exercises: Establishing and implementing an effective and consistent training program is arguably the most critical of all the lanes of the Continuum, and certainly an essential companion to SOPs, Technology, and Usage. It is important to recognize that training goes beyond initial training and should always include a plan for remedial/recurring updates and exercises to practice the skills taught and demonstrate proficiency. Training/Exercises are noted in a best practice when the success of a best practice is achieved and/or enhanced through the development and implementation of training programs.

Usage: While effective usage is often considered the goal of a best practice and the continuum, it also plays an important supporting role to the other four lanes. Usage reveals the areas where governance is needed; it tests the standard operating procedures for efficiency, validates the technology and/or need for upgrading, and reduces the requirement for remedial training by keeping personnel familiar with the process.

3. Individual Best Practice Development Process

3.1   Initiation of a New Best Practice
A Best Practice is initiated by individuals who have observed, read case studies about an incident, or are otherwise aware of situations in which interoperable radio communications were not optimal. Many times, the individual has encountered similar conditions and believe a better approach would help improve conditions.

3.2   Radio I/O Best Practice Working Group
The Radio I/O Best Practice Working Group works under the guidance of the NPSTC Interoperability Committee. The Committee is provided updates in regular monthly meetings

and is asked to provide peer review and comments for each Best Practice Statement when it reaches final draft form.

3.3　　Submittal of a Best Practice and the Role of a Best Practice Manager

A standard template has been developed that describes the basic information and format needed to submit a practice. Submission of a topic for consideration can be done at any time. Anyone submitting a request for the development of a new best practice is encouraged to help shepherd it through the process to ensure the final document meets the intent of the original submission.

3.4　　Collecting Supporting Elements and Relevant Information

The development of a Best Practice in the Working Group has been accomplished through the use of email, scheduled conference calls, presentations, and the submittal of supporting information that helps clarify and build a case for the practice All members of the Working Group are encouraged to send in any supporting documents or information they feel will support any of the best practices.

4. Creating and Approving a Best Practice

4.1　　Discussion and Review in Working Group and Interoperability Committee

Each best practice is discussed within the whole Working Group. The Working Group shares ideas and comments that create the best practice information. Members are polled to volunteer as Best Practice Managers for each individual best practice statement and work either independently or within a small group to create the initial draft. The initial draft is developed either within the worksheet or within the final report format version.

4.2　　Final Draft Development

Following the initial build out, a smaller writing group and the individual Best Practice Manager will refine the draft for consistency of language and format. It will then be reviewed by the Best Practice Manager to ensure that the content has not been significantly changed. The final draft is returned to the whole Working Group for review and final editing based upon the submissions/comments received.

4.3　　Peer Review

Following approval within the Working Group, the draft document will be presented to the Interoperability Committee for review and comments. Submissions received from the Interoperability Committee will be returned to the Working Group for consideration and consolidation prior to sending the final draft through the NPSTC editing process.

4.4　　Adoption of Best Practice by NPSTC Governing Board

Upon final approval by the Working Group and Committee, the document is sent to the NPSTC Governing Board to approve, deny, or return with comments. Questions or changes requested by the Governing Board will be addressed prior to distribution of the document through the normal NPSTC process.

5. Maintaining Best Practices and Developing New Practices

5.1   Annual Review and Certification of Best Practice by Radio I/O Best Practice Working Group

The Radio I/O Best Practices Working Group will define an annual review date as a part of the Best Practice document. On this anniversary date, the Working Group will determine if it is still valid as it stands or should be revised or retired. Any and all changes will be addressed through the same Working Group process and once finalized, announced as an update for review and use by public safety agencies.

5.2   Reviewing Technical Standards for Best Practice Necessity by Radio I/ O Best Practice Working Group

When technical standards are identified as a reference or used as a core item in a best practice, the best practice is to direct the reader to the appropriate document rather than state them within the practice. The goal in doing so is to keep the best practice up to date and relevant and reduce the amount of review and editing necessary as standards change.

5.3   Hosting Best Practice Documents and Referable Resources

When possible, referenced documents and resources will be linked to an outside or responsible website or authority. If a reliable source is not available, relevant documents will be hosted on the www.NPSTC.com website and links will be provided to their location there. Routine review of the website will confirm the referenced documents/links remain valid.

6. Contributors List

The list of contributing members for each best practice will be developed as the best practice is completed for publication.

7. Contributors to this Report

Numerous members of the Ratio Interoperability Best Practices Working Group representing the public safety, government, academia, and industry communities contributed to the creation and review of this document.

NPSTC would in particular like to thank the following participants of the writing group who were instrumental in the development of the overall report –

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