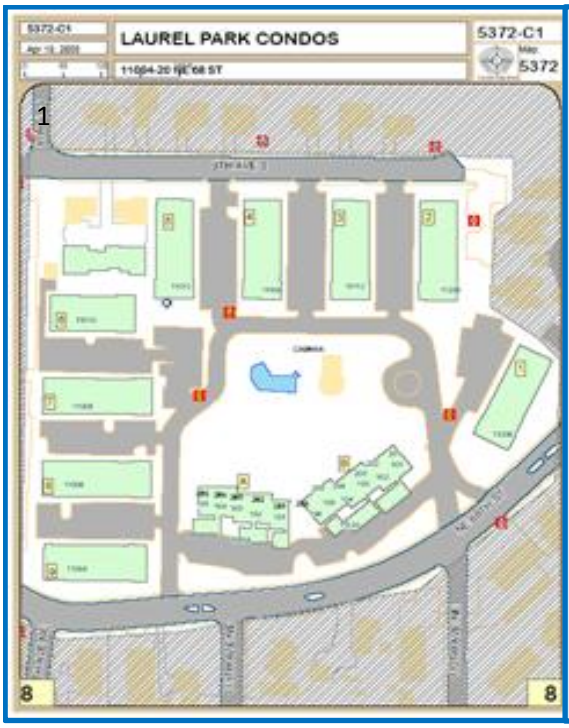

Overview Document: Incident Symbology – Phase 3

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in partnership with
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I. Executive Summary

Every day, police, fire fighters, 9-11 dispatchers, emergency managers, and other emergency responders use maps to plan for, mitigate against, respond to, and recover from real world incidents. It is imperative that these maps are quickly and accurately understood so that they can be used to make mission critical decisions in high stress environments, and ultimately they aid in saving lives and changing the outcomes for survivors. Key to making maps effective decision support tools is the use of consistent symbols that are clearly understood by all.

While national and international standards fulfill many symbol needs, there still exist gaps in incident symbols and the supporting frameworks. The National Alliance for Public Safety GIS Foundation (NAPSG) has been working over the past five (5) years with the U.S. Department of Homeland Security (DHS) to bridge the gaps by developing a consistent incident symbology framework, guideline, and symbol set for use at the incident level on maps and in geographic information systems (GIS). NAPSG's first two phases of work have focused on symbol needs for the following symbol categories: hazard symbols, incident symbols, and pre-incident symbols.

NAPSG's incident symbology efforts have been focused on developing a national guideline that is entirely voluntary and can be readily adopted and used, as it was created by and for emergency responders. Since NAPSG is not a formal standards development organization, the incident symbology framework, guideline, and symbol set are not formal standards. Rather, they are intended to aid in the process of standardizing symbols used on map products during incident planning and operations, and they are therefore referred to as a standardized incident symbology guideline and symbol set.

NAPSG is now embarking on a third phase for this effort. The two primary objectives of the third phase are to:

1. Identify priority needs and gaps in NAPSG's incident symbology guideline and symbol set that pull from commonly used symbols in other national and international symbology efforts. NAPSG will address the highest priority needs in the third phase and will outline several needs that will be considered in future phases.

2. Develop version 1.0 of an implementation toolkit for use by public safety and emergency management nationwide to aid in the adoption and use of NAPSG's incident symbology guideline and symbol set. The first version of the toolkit will include the following: an updated incident symbol set available in multiple formats, initial map templates that apply the symbol set, an initial geodatabase schema, and a practical guidance document on how and why to implement NAPSG's incident symbology guideline and symbol set.

This Overview Document focuses on the first objective and provides information about lessons learned from past efforts, core requirements that serve as the foundation of the guideline and symbol set, potential priority areas for the third phase, and a summary of the process that will be used. Another goal of this Overview Document is to solicit comments and ideas from public safety officials and GIS responders nationwide on key gaps and the overall approach. Together both will insure that the direction undertaken in this third phase is on target and addresses the highest priority symbology needs.

II. Background

Every day, first responders, elected officials, state emergency managers, and even the general public use symbols to help communicate actionable information necessary to make decisions regarding planned events and incidents. The general public also uses symbols on a daily basis to navigate through airports & other facilities, on live traffic maps in their global positioning systems (GPS), and on basic mapping apps on their mobile devices. Emergency 911 dispatchers use symbols to understand and provide critical hazard and basic incident type information when dispatching response personnel. Emergency Operations Center (EOC) personnel use symbols to communicate mission critical information that supports situational awareness and strategic decision making.

Symbols are used every day worldwide with the purpose of communicating what might seem as more mundane, yet still important, information. They are used on road signs, public buses, airplanes, shopping malls, post offices, train stations, and in nearly all other public spaces. In some cases, these symbols provide the general public with basic information about what to do in the event of an emergency. For example, in the case of a building fire, the building occupants will use signs with universal exit symbols that help guide them out of the building. When exiting, the occupants may encounter other signs containing symbols that inform them of a potential hazard and how to avoid it.

All of these symbols have a few things in common, including:

1. They have widely recognized color and design characteristics. For example, the color red on a symbol indicates “something that needs attention” or “hazard”, and the color green on a symbol indicates “access”, “path” or “go”. This is illustrated by the universal traffic light to the right.
2. They are graphical or iconic and typically use a widely adopted international standard, or they are so prevalent that they have become a default standard. An example of a widely accepted international standard are the symbols used on hazardous materials (HazMat) placards.
3. They are part of national and/or international standards that are used by the general public, they do not require formal training to ensure their effectiveness.

While national and international standards fulfill many symbol needs, there still exist important, unmet needs and gaps in standardized incident symbols and the supporting framework and guideline. Several efforts to fill standardized symbol needs have been supported by DHS, not-for-profit organizations, other government agencies, and code and standard development organizations (SDOs).

Most of these efforts, and their associated incident symbol sets, have been focused on addressing standardized symbol needs for a specific incident type (such as hurricanes or train derailments), mapping applications, or types of data. The next critical step is to bring the strengths and lessons learned from these disparate efforts together to define a strategy for harmonizing and filling the unmet needs and gaps in incident symbols. Below is a chart of the incident symbol sets and frameworks that are used as inputs to address these unmet needs and gaps through the third phase of this effort:

Entity	Symbology Focus Areas
American National Standards Institute (ANSI) and Federal Geographic Data Committee Homeland Security Working Group (FGDC HSWG)	Incident and event type focus that includes infrastructure symbols and some operational symbols. Many symbols are designed for use by the general public, but are not necessarily usable when scaled down for local incidents and pre-incident planning.
UN Office for the Coordination of Humanitarian Affairs (OCHA)	All-hazard symbols for use across multiple audiences, including the general public, during disaster and humanitarian relief.
Canadian Emergency Mapping Symbology (CEMS)	Similar to the ANSI symbols, but are more colorful and graphic in nature.
Australasian All Hazards Map Symbology (AAHMS)	Comprehensive and all hazards symbol set applicable for use by first responders and emergency management across levels of government in Australia.
National Wildfire Coordinating Group (NWCG)	Incident command symbols that are consistent with the NIMS and other map symbols, used primarily for wildland fire incidents.
NAPSG Incident Symbology Framework and Symbol Set through 2nd Phase (NAPSG)	Pre-incident planning at the building level and incident area, primarily for use by local fire service, law enforcement, local emergency management, and search & rescue personnel. Expansion planned in the third phase includes more emergency management needs and greater scalability across all levels of government.
Penn State Symbol Store	Represents a compilation of symbols from across a multitude of sources and is intended to support several applications beyond public safety and homeland security. This input is used as a supporting reference and the authoritative source for relevant symbols is the primary reference.

It should be acknowledged that detailed analyses of the specific uses, strengths, and weaknesses of all of the above symbol sets and frameworks were included in NAPSG's previous report at the conclusion of the second phase[1], and some additional information is contained in Appendix 1 of this document.

III. Lessons Learned from Phases 1 and 2

During the past five (5) years, NAPSG has been working with DHS to develop and promulgate an incident symbology framework, guideline and symbol set that supports and is consistent with the National Incident Management System (NIMS). Through this process, there have been numerous lessons learned that provide critical input into the third phase. In those prior phases, public safety stakeholders and GIS responders from across the United States came together as a part of the NAPSG Incident Symbology Working Group. Together, they examined and assessed several of the aforementioned symbology efforts with the goal of bringing together current standards and the most effective and widely used

[1] National Alliance for Public Safety GIS Foundation. *A Final Report of the National Alliance for Public Safety GIS Foundation's (NAPSG) Incident Symbology Working Group* Sept. 2013 <http://napsgfoundation.org/napsg-incident-symbology-guideline-symbol-set/>

symbols into a single consistent guideline and symbol set. There are several key lessons learned from NAPSG's past efforts that will be used to inform the next iteration of this effort, including the following:

1. The level and scope of decision making that the symbols are intended to support varies greatly across the various public safety disciplines and across different levels of government. For example, the symbols on a map used by a Battalion Chief on a building pre-plan are different than the symbols used by a Crime Analyst during the forensic investigation process.
2. Incident level map products used in public safety and emergency management are diverse, and as such the symbology needs to be flexible and scalable. Symbology must provide the ability to map both points and areas to support the scaling requirements. For example, a base camp may be mapped as a point at one scale, but, when the user "zooms in", it must be shown as an area with several features or structures within that area. In other cases, map symbols need to be flexible to properly portray the features that they depict in different mapping mediums:
    a. Paper Maps – Such as map books, wall maps and incident maps used in the field.
    b. Mobile Applications – Such as tactical situational awareness, damage assessment collection, automated vehicle location (AVL) and pre-planning applications on mobile data terminals, tablets, and other mobile devices.
    c. Web-Based Mapping – Such as strategic situational awareness applications, EOC management applications, ArcGIS Online, online & cloud-based mapping solutions, and public information mapping applications.
3. Consistent with the above, the symbology needs to be flexible for modifications based on the scale of the maps, priority of the information being conveyed, varied levels of detail, and use of black & white versus color.
4. Symbols that are still frequently used on paper maps should retain key features that allow them to be hand drawn in the field.
5. Symbols should not require much, if any, training to be easily understood and used.
6. Symbols should be applicable and used for day-to-day planning, exercising and incident operations - and for large catastrophic incidents. This insures that the map users are familiar with the symbols and are not required to interpret them during the high stress periods of real world events.
7. Incident symbology guidelines and symbol sets need to retain a consistent set of basic characteristics, including:
    a. They are organized by a consistent set of symbol categories.
    b. Standard symbol shapes are determined for each category.
    c. A symbol shape is dependent on and informed by the intended map output and use.
    d. Symbols can be dynamic in nature, changing characteristics such as color, intensity or size based on changing conditions, such as unit status or availability.
8. Symbol density or clutter can pose significant issues that can hinder the use of maps as decision making tools. While scale dependencies have helped, the ability to dynamically define and query views when using computer and web-based mapping applications is still needed. An example of this is the ability to change the color of a resource symbol (i.e. police vehicle) based on its status

or availability. Some of the values in these attributes to help create a scheme for dynamically querying data include:

a. Date/time within the incident.
b. Scope and scale of the map consumer or decision maker (i.e., ranging from a task level firefighter to an incident commander or emergency manager).
c. Whether or not the map would be used or released to the public.
d. Pre-determined scale of risk (i.e., level of intensity around the incident impact area).

IV. Priorities for 3rd Phase

The third phase of this effort will focus on several priority areas that will begin to address critical, unmet needs and gaps with incident level symbology.

1. **Enhance Symbol Scalability and Dynamic Characteristics** – This includes enhancements that will optimize use in situational awareness, EOC management applications, and other decision support capabilities. Relevant symbol categories, and their features, will include enhancements that will allow for greater use in online and web-based mapping applications. This may include automated scaling of symbol size, a consistent halo effect around the most relevant symbols, and automated scaling. Further, some symbols will be updated to be more dynamic and allow for characteristics such as color, size and intensity to reflect changing conditions to be viewable. For example, symbols for emergency vehicles should be dynamic so that they not only portray the vehicle location, type and size, but also changing status information such as "in-service", "out-of-service" or "available". Another example would be in-road temperature sensors that only display when a pre-determined threshold is met indicating freezing road conditions. Features may increase intensity or change color alerting the map user of increasing risks and dangers. The symbol set will be updated to include key symbols in the following categories:

Priority Infrastructure Symbols	Priority Incident Type Symbols	Priority Special Event Symbols
1. Buildings 2. Stadiums/Arenas 3. Bridges 4. Tunnels 5. Transportation Hubs	1. Blizzard 2. Building Collapse 2. Child Abduction 3. Coastal Flood 4. Dust Storm 5. Earthquake 6. Explosion 7. Fire - Structural & Wildland 8. Flash Flood 9. Hazardous Materials Release 10. Hurricane 11. Land slide 12. Nuclear Power Plant Compromise 13. Radiological Hazard 14. Terrorism Threat & Attack 15. Tornado	1. Parades 2. Marathons and Sporting Events 4. Prominent Funerals 5. Political Events 6. Concerts 7. Public Demonstrations

2. **Expand to Be Inclusive of Highest Priority Threats, Hazards and Disciplines** – Historically, and by design, NAPSG's symbology efforts have focused heavily on the needs of local fire service and some law enforcement. This phase will expand the existing guideline and symbol set to include priority categories and symbols for emergency management, law enforcement and some mass care and public health. This expansion in the third phase is reflected in the table above.

3. **Expand to Support Line and Polygon Symbols** – Thus far, NAPSG's symbol set and framework has been focused exclusively on point symbols. This phase will see the expansion of the framework that will fill key gaps in both line and polygon symbols.

Polygon Symbols	Line Symbols
1. Zones • Drive Zone • Search Area Zone • Restricted Zone • Crime Zone • Incident Impact Zone • Exclusion, Transition, and Safe Zones • No Go Zone (area that is completely off limits to public and all first responders) 2. Divisions, Branches, or Sectors • North, South, East, West • Response Areas • Other Geographic Identifiers	1. Road Closures • Fully Closed • Partially Closed • Emergency Vehicle Access only 2. Emergency Routes • Emergency vehicle routes • Evacuation routes

4. **Integrate Standardized Search and Rescue Symbols** – The Federal Emergency Management Agency's (FEMA) National Urban Search & Rescue (US&R) System has developed and implemented a standard symbol set for USAR. This symbol set includes symbols used in damage assessment and victim location. These symbols will be evaluated and considered for inclusion into the NAPSG standardized symbol set and guideline since they can be used for USAR, non-urban search and rescue, Incident Management Teams, and other first responders.

5. **Explore the Feasibility to Develop and Include Public Alert and Warning Symbols** – The need has been identified to develop and introduce a standardized set of symbols to help ensure that public alerts and warnings are effectively communicated to the broadest possible audience regardless of language, literacy level and access & functional needs. During this phase, NAPSG will examine the highest priority symbols for public alerts and warnings and begin to assess if the symbology framework and symbols would support the business requirements for public alert and warning symbols. NAPSG will also produce an initial set of symbols for some of the highest priority alert and warning symbols, in coordination with DHS and FEMA's Office for Integrated Public Alerts and Warning (IPAWs). Many of these priorities overlap with the "Priority

Incident Type Symbols" listed previously, and when feasible, the requirements will be combined to produce a single symbol for inclusion in NAPSG guideline and symbol set. Below is a table that outlines the highest priority public alert and warning symbols (as provided by IPAWs), which will be considered for the initial development in this area during the third phase.

Type of Event	Event Code	Brief Description
Blizzard Warning	BZW	A warning of sustained winds or frequent gusts of 35 mph / 15 m/s or greater with heavy snow is forecast for a period of 3 hours or more. A blizzard tends to reduce visibilities to 1/4 of a mile (400 m) or less. A Severe Blizzard Warning is a variety issued is some cases of winds above 45 mph / 20 m/s and temperatures below 10°F/-12°C.
Child Abduction Emergency	CAE	An AMBER Alert or a Child Abduction Emergency is a child abduction alert system. Alerts usually contain a description of the child and of the likely abductor.
Civil Emergency Message	CEM	A warning meant to warn of an in-progress or imminent significant threat(s) to public safety and/or property. For example, the CEM could be used to describe an alert issued by the National Terrorism Advisory System.
Dust Storm Warning	DSW	A warning issued when blowing dust is expected to reduce visibility frequently to 1/4 mile or less, generally with winds of 25 mph or more.
Emergency Alert Notification (Presidential)	EAN	The national activation of the Emergency Alert System (EAS) and can only be activated by the President or his/her representative. The order of the broadcast: (1) Presidential message (2) Reports from local, state or regional authorities (3) National Information Center.
Earthquake Warning	EQW	A warning of current or imminent earthquake activity. Authorized officials may recommend or order protective actions according to state law or local ordinance.
Fire Warning	FRW	A warning of a spreading wildfire or structural fire that threatens a populated area. Evacuation of areas in the fire's path may be recommended by authorized officials according to state law or local ordinance.
Flash Flood Warning	FFW	Issued when a flash flood is imminent or occurring in the warned area. A flash flood is a sudden, violent flood after a heavy rain, or occasionally after a dam break. Rainfall intensity and duration, topography, soil conditions, and ground cover contribute to flash flooding.
Hurricane Warning	HUW	Issued when a hurricane with sustained winds of 74 mph (65 knots, 118 km/h) or higher is expected. The National Hurricane Center will issue the HUW when tropical storm conditions are likely in the warned area within the next 36 hours.
Law Enforcement Warning	LEW	A warning of a bomb explosion, riot, or other criminal event.
Nuclear Power Plant Warning	NUW	A warning of an event at a nuclear power plant classified such as a Site Area Emergency or General Emergency as classified by the Nuclear Regulatory Commission (NRC). A Site Area Emergency is confined to the plant site; no off-site impact is expected.

Type of Event - *Continued*	Event Code	Brief Description - *Continued*
Radiological Hazard Warning	RHW	A warning of the loss, discovery, or release of a radiological hazard. Examples include: the theft of a radioactive isotope used for medical, seismic, or other purposes; the discovery of radioactive materials; a transportation (aircraft, truck or rail, etc.) accident which may involve nuclear weapons, nuclear fuel, or radioactive wastes. Authorized officials may recommend protective actions to be taken if a radioactive hazard is discovered.
Shelter in Place Warning	SPW	A warning of an event where the public is recommended to shelter in place (go inside, close doors and windows, turn off air conditioning or heating systems, and turn on the radio or TV for more information).
Tornado Warning	TOR	An alert issued to warn that severe thunderstorms with tornadoes may be imminent. It can be issued after a tornado or funnel cloud has been spotted by eye, or more commonly if there are radar indications of tornado formation. Issuance of a tornado warning indicates that residents should take immediate safety precautions.

V. Process for Addressing Needs & Gaps

The process that NAPSG will use to address the priority needs and gaps in the third phase will be based on the process used during the initial two phases, with some enhancements. The foundation for all of NAPSG's incident symbology efforts past, present and future is a group of local public safety officials and GIS responders from across the nation that form NAPSG' Symbology Working Group (SWG). This approach ensures that all of the products are truly developed by and for the public safety community. This group's national perspective is grounded in local, day-to-day and catastrophic incidents, a perspective that is critical in building the incident symbology framework and symbol set. The SWG membership will be expanded in the third phase to include practitioners with specific expertise in critical infrastructure protection issues, symbol use in public alerts & warnings, and other specializations as deemed necessary. Below is a list of some of the agencies that comprise the NAPSG SWG:

- Tualatin Valley Fire Rescue (OR)
- Fire Department of New York City (NY)
- Seattle Police Department (WA)
- Kirkland Fire Department (WA)
- Louisiana Department of Emergency Management (LA)
- Baltimore Metropolitan Council (MD)
- U.S. Forest Service
- Bureau of Land Management

Additionally, NAPSG has a team of Technical Advisors and Subject Matter Experts (SMEs) on staff that are dedicated to this effort. These individuals are also public safety practitioners and GIS responders who individually possess at minimum of 10 years of specialized experience in local and/or state public safety and GIS technology. Their role is to lead the technical development process, ensure operational viability nationwide, and analyze & synthesize input from the practitioners on NAPSG's SWG. NAPSG's

Technical Advisors and SMEs form the Project Team that is responsible for the development of all deliverables associated with each phase of the effort.

During each of the phases of this effort, a series of virtual and in-person meetings are conducted with the Project Team and NAPSG's SWG. Through these meetings, the group discusses the following topics:

- Symbol needs & gaps.
- Symbol priorities.
- Core requirements guiding development of new symbols and updates to existing.
- Technical issues in implementing the symbology framework, guideline, and symbol set.
- Operational issues and considerations in developing the symbology framework, guideline, and symbol set.

As a working group, they collaborate to put any proposed symbols (or updates to existing symbols) through a testing process. The testing process follows several key steps that are outlined below:

Step	Actions for Working Group Testing Process
1	Members of the SWG create maps for different types and levels of incidents that apply to the symbols. Each map illustrates the following features: hazards on an incident; any features that can help mitigate risk during an incident; location of command functions; and identification of any access issues.
2	Meetings are held where SWG members review each other's maps and the symbols used. They also identify and discuss any challenges and questions with each map and the associated symbols used.
3	With input from individual SWG members, the Project Team then decides whether or not the proposed symbols can be added and/or if any modifications need to be made to the framework and guideline
4	Based on result of step 3, updates are made to the symbol set, framework and/or guideline as appropriate and are included in the next release.

The process for the third phase has been enhanced to include additional practitioner input and validation efforts. This includes a 30-day comment period where practitioners nationwide will provide input and comment on the content contained in this document. NAPSG will post this document, along with a comment matrix, to its website (and to the DHS Science & Technology Directorate's First Responder Community of Practice website) and release an article about the opportunity for comment. NAPSG will compile, assess and adjudicate each individual comment received during the 30-day period. All input will be considered for incorporation into the current effort as well as in future phases.

Additionally, NAPSG is developing a large-scale survey that it will release for input by public safety officials and GIS responders nationwide, and potentially it will be released internationally. This survey will be used to collect information that will inform current and future technical and operational requirements for the incident symbology framework, guideline and symbol set. This survey represents an additional level of national practitioner input that will inform the development process.

VI. Future Outlook

The efforts in the third phase will fill numerous priority gaps for incident symbology. NAPSG recognizes, however, that additional gaps will still exist that will need to be filled. Additional gaps and unmet needs will be identified through the survey component during the third phase and can be addressed in future phases. Further, once the updated symbology guideline and symbol set is released at the end of the third phase, it will be critical that it is implemented and used during real world events and exercises. Lessons learned coming from its use will need to be taken into account during future phases. Based on known gaps and existing lessons learned, below are several areas that NAPSG plans to consider as priorities for a future fourth phase.

1. **Increased Flexibility and Scalability** – Enhancing many symbols to allow for more dynamic viewing will increase the flexibility and scalability of the symbol guideline and symbol set. In future phases NAPSG will work to develop a framework that will allow for simultaneous creation of map information with role-based viewing. NAPSG will also look at expanding the number of dynamic symbols that allow for characteristics such as color or intensity to change based on changing information such as status or availability.
2. **Increased Number of Polygon Symbols** – The third phase includes the development of the highest priority polygon symbols. Through the survey and other modes of national engagement, NAPSG will develop a list of the next tier of priority polygon symbols and plans to address them in future phases.
3. **Additional Symbols for Public Alerts and Warnings** – This area depends on the results from the initial effort in the 3rd phase, which explores the feasibility of including public alert and warning symbols in NAPSG's symbology framework, guideline and symbol set. Building out additional symbols for this area assumes that the work under the third phase proves feasible and effective. During a future fourth phase, NAPSG would work to complete the initial development of all 14 priority public alert and warning symbols. NAPSG would also coordinate focus groups of target individuals (e.g., Public Information Officers) who would review and provide feedback on the initial 14 public alert and warning symbols. Their feedback would then be used to update the symbols as needed.
4. **Monitoring, Evaluation and Lessons Learned from Real World Applications** – A critical next step at the conclusion of the third phase is the implementation of the updated symbology guideline and symbol set by local public safety agencies. NAPSG plans to select a couple of agencies that intend to implement the updated symbology guideline and symbol set, where NAPSG will evaluate their effectiveness in the field. Lessons learned from these real world applications will serve as a critical baseline for validation and refinement in future phases.
5. **Outreach and Education on How and Why to Implement the Standardized Symbol Framework, Guideline and Symbol Set** – During a fourth phase, NAPSG will develop and implement a comprehensive outreach and education plan around how and why to implement NAPSG's updated standardized symbology framework, guideline and symbol set. This is an important next step in facilitating its adoption and use by public safety across all levels of government.

Appendix A

A. Summary of Symbology Inputs

This appendix provides a high level overview and brief comparison of the primary symbology frameworks and symbol sets used as inputs in informing the third phase of this project. This analysis used the Central United States Earthquake Consortium's (CUSEC) Capstone 2014 Situational Awareness Symbology Brief[2] in developing this analysis. The analysis results for each of the symbol sets varies from the CUSEC brief due to additional symbol inputs and the updated currency of information on each of the symbol sets.

Below is a table that provides a high level comparison of some of the capabilities of each of the symbology frameworks and symbol sets used in the 3rd phase of NAPSG's efforts.

Symbol Set	Formats	Used For	Scalable	Current Symbol Categories				
				Pre-Incident	Incident	Hazards	Operations	Infrastructure
ANSI and FGDC HSWG	TTF PNG	Paper Web	Y					
UN OCHA	PNG EMF SVG TTF	Paper Mobile Web	Y					
CEMS	PNG Esri	Web	Y					
AAHMS	PNG	Paper Mobile Web	Y					
NWCG	Esri	Paper	Y					
NAPSG	PNG Esri	Paper Mobile Web	Y					

Key: Green = Thorough Coverage Orange = Limited Coverage Red = Minimal Coverage

B. Evaluation of Map Symbols for Each Input

The analysis and evaluation of symbols that relate to public safety mapping efforts are based on the following evaluative criteria:

[2] U.S. Department of Homeland Security Science & Technology Directorate. *Capstone 2014 Situational Awareness Symbology Brief* 2014 <http://www.cusec.org/capstone14/documents/CAPSTONE_S%26T_Symbology.pdf>

- Does the symbol have a criteria or design where the user can begin to determine information without a legend?
- Is there flexibility in the design of symbols for multiple types of map products at various scales?
- Does the symbol guideline/standard cover information from the local responder community to large scale situation awareness? This not only includes typical responders such as law enforcement or the fire service, but other types of responders such as search and rescue, animal rescue, mass care, and others.
- Can the graphic associated with the symbol help determine what the information and action is with little-to-no special training?

While this document doesn't evaluate the North Atlantic Treaty Organization's (NATO) symbol set, it should be noted that there are many similarities between it and NAPSG's symbology framework, guideline and symbol set. This is evidenced by the commonalities with the core requirements guiding NAPSG's symbology effort. Further, both public safety and military entities such as NATO rely on map information to take action to accomplish a particular objective.

C. American National Standards Institute (ANSI) and the Federal Geographic Data Committee (FGDC) Homeland Security Working Group (HSWG) Symbol Set

1. Sample

2. About

ANSI 415[3] is a standard created from the work of the Federal Geographic Data Committee (FGDC) Homeland Security Working Group. Its initial step was to create a scheme for a scalable symbol set for multiple disciplines. This effort established an all hazards symbol set that is focused on helping to manage an incident and support situation awareness

[3] American National Standards Institute. *Homeland Security Mapping Standard and Point Symbology for Emergency Management: ANSI INCITS 415-2006* Jul. 2006 <http://webstore.ansi.org/RecordDetail.aspx?sku=ANSI+INCITS+415-2006>

3. Pros & Cons

Pros	Cons
Covers a wide range of symbols from • Operations • Natural incidents • Human Incidents • Critical Infrastructure	Not able to hand draw
Includes status of Critical Infrastructure Protection and Operations features	While a large number of symbols, it doesn't cover everything
Does have flexibility in symbol design if symbol density becomes too great	Symbols don't contrast from one symbol to the next
	Symbols don't exist for many command functions

4. Analysis:

This symbol set is a crucial effort that illustrates some of the most important features. However, the symbols prove to be a challenge for ground level responders since some of the graphics are not easily identifiable and gaps in symbols for common incident features. These symbols can be scaled to not include the graphic within the shape.

Criteria	Yes/No	Comments
Consistent design not needing legend for initial information	Yes	Since the symbol categories are first defined based on the shape of a symbol, it is possible to initially determine what the symbol means.
Flexibility in scale	Yes	There is added flexibility if you use the shape only for a smaller point since the ANSI 415 framework is categorized based on shape.
Covers full spectrum of responders	No	There are several missing symbols that directly relate to NIMS and incident operations.
Graphic associated is used in other types of symbols	Somewhat	Many of the symbols are intuitive but not all.

4. Resource Link

http://webstore.ansi.org/RecordDetail.aspx?sku=ANSI+INCITS+415-2006

http://www.fgdc.gov/HSWG/index.html

6. Format PNG, True Type Font

7. Scalable Yes (12-72px)

D. United National Office for the Coordination of Humanitarian Affairs (OCHA) Symbol Set

1. Sample

2. About

The UN OCHA symbol set was created to help relief workers present emergency and crisis-related information quickly and simply.[4] This set contains over 500 symbols using a consistent blue and white scheme which contrasts well with most maps. Many of the icons are from the Noun Project[5].

3. Pros & Cons

Pros	Cons
Good color contrast	Symbolizes only situation awareness features
Good public symbols icons	
Icons are from the Noun Project and most are easily understood	

4. Analysis

These symbols are good for situation awareness or intelligence. However they provide little in the way for emergency worker to help manage an incident.

Criteria	Yes/No	Comments
Consistent design not needing legend for initial information	Somewhat	The symbols use icons and graphics that may or may not be recognizable. Also there is no way to indicate what type of category of feature it is.
Flexibility in scale	Yes	

[4] United Nationals Office for the Coordination of Humanitarian Affairs. *OCHA Adds 500 Free Humanitarian Symbols to Communications Tools and Services* Aug. 2012 <http://reliefweb.int/report/world/world-humanitarian-and-country-icons-2012#sthash.BjpG7s6q.dpuf.>

[5] The Noun Project. <http://thenounproject.com/>

Covers full spectrum of responders	No	Does not include symbols that are used daily at the local level by most emergency responders.
Graphic associated is used in other types of symbols	Somewhat	The symbols use common icons and graphics for some things while others would require accessing the legend or attributes.

5. Resource Link

http://reliefweb.int/report/world/world-humanitarian-and-country-icons-2012

6. Format PNG, EMF, SVG

7. Scalable Yes (20-100px)

E. Canadian Emergency Mapping Symbology (CEMS)

1. Sample

2. About

The Canadian Emergency Mapping Symbology symbols derive most of their design from the FDGC HSWG/ANSI 415 symbology effort. This set is commonly used throughout Canada and parts of the US. Includes following categories:

- Incident
- Infrastructure
- Operations

3. Pros & Cons

Pros	Cons
Covers a wide range of symbols from • Operations • Natural incidents • Human Incidents • Critical Infrastructure	Not able to hand draw
	While a large number of symbols, it doesn't cover everything
	Requires ability to display and view color for accurate interpretation

4. Analysis

Since these set of symbols take their design from ANSI 415, a lot of the same concerns exist. These symbols work well on many base maps but since they lack a consistent shape they don't communicate intent of the symbol very well. There is no indication of status or level of hazard.

Criteria	Yes/No	Comments
Consistent design not needing legend for initial information	No	The symbols are pictorial in nature and don't provide any reference to anything like status of feature. The only reference to category is based on color.
Flexibility in scale	Somewhat	While the symbols are scalable based on the file format, if the size what small they may be hard to discern.
Covers full spectrum of responders	No	Most of the symbols are for information only and doesn't necessarily cover information related to responders.
Graphic associated is used in other types of symbols	Somewhat	The symbology uses common symbols for some things while others would require accessing the legend or attributes.

5. Resource Link

Not Currently Available Online

6. Format PNG, Esri (.style format)

7. Scalable Yes (32-400px)

F. Australasian All Hazards Map Symbology

1. Sample

2. About

The Australasian All Hazards Symbology Project[6] uses many of the characteristics common in ANSI 415, FDGS HSWC, and also borrows heavily from the NWCG effort for wildland fire mapping. The Australasian framework is based on three (3) core characteristics, including:

a) Categories (defined by symbol shape)
b) Status (defined by line style)
c) Definition (defined by icon or abbreviation)

3. Pros & Cons

Pros	Cons
Able to be hand drawn	Mostly black and white
Includes dashed line indicating “planned” or “future” feature	While it consists of a large number of symbols, it doesn’t include all symbols commonly used at the incident by local first responders.
More focused on ground level information	Different business methods and systems are employed by Australian public safety that influence some incident level symbols.
Good effort at an “all hazards” approach	

4. Analysis

The terminology and workflows associated with the symbology framework and design are different from that used in the U.S. and appear to be effective for their intended use in the Australasian context. One unique characteristic that is worth noting is the use of dashed lines for some of the symbols which indicated planned resources, an example of the dynamic nature of this symbology framework and its ability to indicate status information. Further, this symbol set represents a good balance of simple (not highly graphical) and graphical symbols based on the operational needs associated with each symbol. .

[6] Intergovernmental Committee on Surveying & Mapping. *Project Report: Australasian All-Hazards Symbology Project* May 2007 <http://trove.nla.gov.au/work/38026184?selectedversion=NBD46043468>

Criteria	Yes/No	Comments
Consistent design not needing legend for initial information	Yes	The design of these symbols follows closely the framework of the ANSI 415 standard so that the shape provides some recognition of what the category of the symbol is.
Flexibility in scale	Yes	
Covers full spectrum of responders	Yes	This efforts in Australia is geared from the ground responder to the emergency manager.
Graphic associated is used in other types of symbols	Yes	The graphics that are used are intuitive since they represent the shape of the feature (such as airplane). There are some local symbols that seem to pertain to Australasia.

5. Resource Link

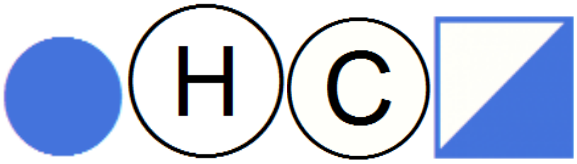
http://trove.nla.gov.au/work/38026184?selectedversion=NBD46043468

6. Format Unknown

7. Scalable Unknown

G. National Wildfire Coordinating Group Symbol Set

1. Sample



2. About

The NWCG symbol set[7] represents a small set of symbols that is focused on the incident management needs associated specifically for wildland fires. This symbol set has been widely adopted and implemented by the wildland fire community. It includes some incident command symbology that is commonly used during wildland fires and is consistent with NIMS.

3. Pros & Cons

Pros	Cons
Contains standards for common ICS symbols	Primarily limited to wildland fire incident needs.

[7] National Wildfire Coordinating Group. *GSTOP/GISS Tips and Tools: Symbol Style Set for ArcGIS* <http://gis.nwcg.gov/gstop_symbol.html>

Has line and polygon symbology	Line and polygon symbology mainly focused on wildland fire, and not inclusive of other threats and hazard.

4. Analysis

This symbol set incorporate a combination of point, line, and polygon symbols. It is focused almost exclusively on the mapping and symbology needs associated with wildland fires however, it does include some symbols that are more general for incident command functions.

Criteria	Yes/No	Comments
Consistent design not needing legend for initial information	Somewhat	Widely used symbol set by the wildland fire community and often does not require a legend.
Flexibility in scale	Yes	Most of the symbols can be scaled down in size to fit on most scales.
Covers full spectrum of responders	No	These symbols are only for wildland firefighting and some incident command positions.
Graphic associated is used in other types of symbols	Somewhat	Since this symbols set is so job specific and doesn't rely on commonly used icons, this would be difficult to accomplish given its framework.

5. Resource Link

http://gis.nwcg.gov/gstop_symbol.html

6. Format

Esri (.style format)

7. Scalable

Yes (Based on Esri's Character Marker Symbols, can be scaled from 5-70px)

H. National Alliance for Public Safety GIS Foundation (NAPSG) Incident Symbology Framework, Guideline, and Symbol Set through the 2nd Phase

1. Sample

2. About

The NAPSG Incident Symbology Workgroup formed to find commonality between many symbols efforts. Contrary to other efforts, this group's focus is to:

- Enhance and refine a framework, guideline, and symbol set where symbols can be developed that allow for flexibility in design.
- Support user communities that have an interest in creating a set of symbols for their skill set

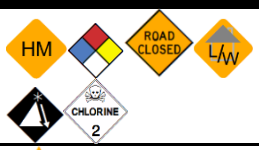
This work is heavily influences by the ANSI 415 standard, National Fire Protection Association (NFPA) 170 & 704, Department of Transportation (DOT) placarding, the Australasian All Hazards Symbology, NWCG, and even DOT based road signs. The NAPSG SWG identified three main categories in the initial phases for supporting local level emergencies including the following:

Incident Symbols

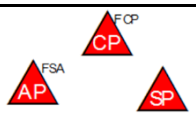
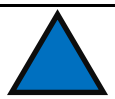
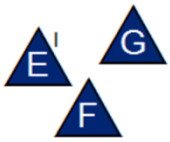
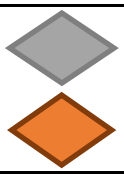
	Purpose	Examples	Shape	Examples Symbols
Incident Symbols	**Incident Resources and Fixed Command Features**			
	Features with a semi fixed position that supports the management of the incident	• Equipment • Locations for responders and civilians to assemble • Useful landmarks pertaining to the incident		C B
	NIMS Command Structure Locations			
	Location of features that relate to the National Incident Management System Command Structure. Can be used for semi static mapping or if possible, active mapping of commanders at an incident.	• Task Forces and Strike Teams • Groups and Divisions • Sections • Branches • Support	NIMS	FIRE SAR IC PIO
	Unit Symbols			
	Symbols representing the semi-static to active location of a unit. Based on FEMA Resource Typing. Also based on the location of where the unit is "working"	• Fire Companies (Engine, Brush, Ladder, etc.) • HazMat • Police Units (Patrol Car, SWAT, Canine, etc.) • EMS (Medic, Ambulances)	Unit	E WT COM AMB

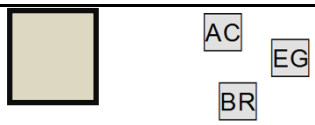
	• SAR (Team) • IMT • Public Health			
Exposures				
The side visible in an incident.	Define the section of the incident		"A" (Label in quotes)	"A", "B", "C", "D"

Hazard Symbols

Hazard Symbols				
Hazards				
The location of any hazard that may cause harm, create hassle, inhibit access to responders and the public. Hazards should be mitigated, observed, or avoided Symbols are variable other than shape	• NFPA 704 • DOT Placarding • Orange Diamond • FDCG incident Symbology			
Safe Zone	Consistent with NWCG			

Pre-Incident Symbols

Symbol Category	Definition	Physical Examples	Symbol Shape	Symbol Examples	Standard Taken from
Access Point	Access point and ways to access a building or incident area and features related to	Knox Box, Elevator, Access Point			NFPA, Traffic Color
Assessment Features	Alarms and other	Burglar Alarm, Fire alarm control			NFPA
Utility Shutoffs	Location of where you shutoff utilities				NFPA
Detection/Extinguishing Equipment	Detectors and building extinguishment systems	Smoke, Duct, Pull Station			NFPA
Ventilation	Place to manage the exhaust of gases	Skylight, Smoke Control			NFPA

Water Flow Control Valves and Water Sources	Water flow devices	Fire department connections, PIV		NFPA
Equipment Rooms.	Location of features			NFPA

3. Pros & Cons

Pros	Cons
Contains standards for common ICS symbols	Not yet incorporated into any formal standards.
Merges the symbols of different symbology guideline based on commonalities among them	Only includes point symbols guideline currently, and lacks frequently used polygon and line symbols.
	Does not currently include symbols for frequently used incident and event types.

4. Analysis

Criteria	Yes/No	Comments
Consistent design not needing legend for initial information	Yes	
Flexibility in scale	Yes	
Covers full spectrum of responders	No	
Graphic associated is used in other types of symbols	Somewhat	

5. Resource Link

http://napsgfoundation.org/napsg-incident-symbology-guideline-symbol-set/

6. Format PNG, Esri

7. Scalable Yes