



# Progress on Developing Standards for DHS Map Symbolology

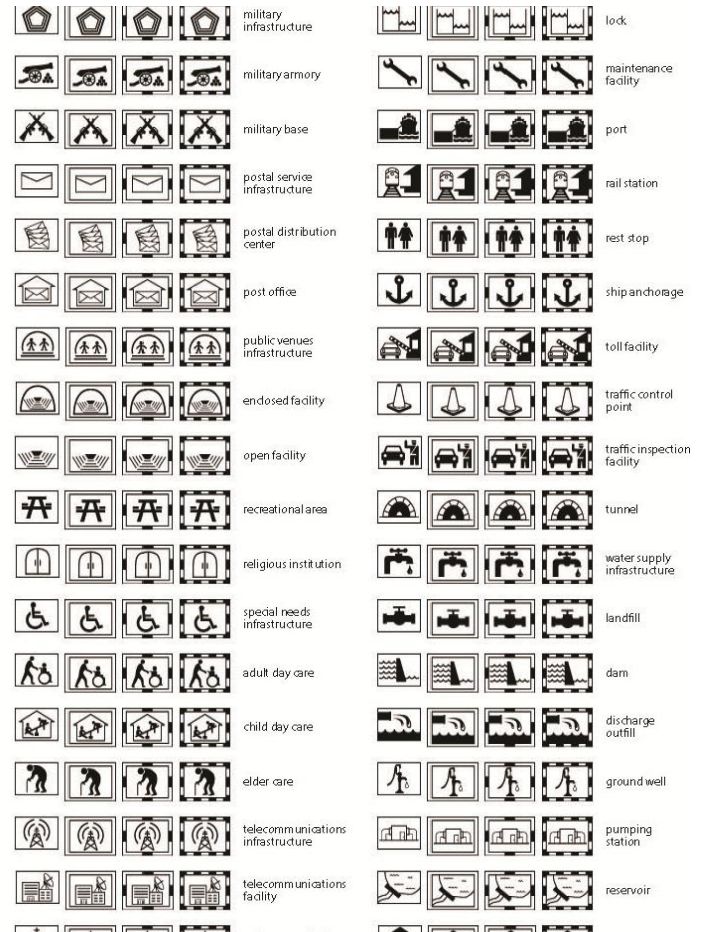
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# Outline



- Motivation
- Approach
- Interview Results
- Proposed Process
- Future Work



# Sponsorship, Motivation, and Scope



- **Diverse DHS organizations produce or use maps daily**
  - Audiences range from geospatial analysts to general public
- **No consistent set of map symbols used across DHS**
- **ANSI INCITS 415-2006 intended for emergency management mapping**
- **Objective: Develop process for symbol standardization**
- **Sponsored by DHS S&T Directorate's Command, Control, and Interoperability (CCI) Division**

# ANSI Standard



- **Point symbol set designed for emergency response**
  - Goal was to facilitate common situational awareness
- **Federal/state/local stakeholders took part in the process**
- **Symbols designed to work in black & white**
  - Outline shapes used to distinguish between symbol types (incidents, natural events, operations, infrastructure)
- **Evaluation conducted with first responders**
  - Made use of an “accept” or “reject” methodology



# ANSI Standard



## ANSI INCITS 415 point symbology standard for emergency mapping - Federal Geographic Data Committee Homeland Security Working Group

INCIDENTS		NATURAL EVENTS		OPERATIONS		INFRASTRUCTURE	
civil disturbance incident	flammable gas	after shock	emergency medical operation	law enforcement operation	food retail	natural gas facilities	airport
civil demonstrations	flammable liquid	avalanche	EMT station	Bar, Alcohol, Tobacco, Firearms & Explosives	grain storage	nuclear facilities	bridge
civil displaced population	flammable solid	earth quake epicenter	ambulance	border patrol	banking finance & insurance	petroleum facilities	bus station
civil rioting	non-flammable gas	landslide	medical evacuation helicopter station	customs service	ATMs	propane facilities	ferry terminal
criminal activity incident	organic peroxides	subsidence	health department facility	Drug Enforcement Administration	banks	government site infrastructure	helicopter landing site
bomb threat	oxidizers	volcanic eruption	hospital	Department of Justice	bullion storage	military infrastructure	lock
bomb	radioactive material	volcanic threat	hospital ship	Federal Bureau of Investigation	federal reserve bank	military armory	maintenance facility
bomb explosion	sportaneously combustible	drizzle	medical facilities not patient	police	financial exchanges	military base	port
looting	toxic gas	drought	pharmacies	prison	financial services other	postal service infrastructure	rail station
poisoning	toxic and infectious	flood	village	secret service	commercial infrastructure	postal distribution center	rest stop
shooting	unexploded ordnance	fog	emergency operation	Transportation on Security Admin.	chemical plant	post office	ship anchorage
fire incident	air incident	hail	emergency collection evaluation point	US Coast Guard	firm manufacturers	public venue infrastructure	toll facility
hot spot	air accident	inversion	emergency incident command center	US Marshalls Service	firm retailers	enclosed facility	traffic control point
non-residential fire	air hijacking	rain	emergency operations center	sensor operation	hazardous material production	open facility	traffic inspection facility
origin	marine incident	sand dust storm	emergency public information center	biological sensor	hazardous material storage	recreational area	tunnel
residential fire	marine accident	snow	emergency shelter	chemical sensor	industrial site	religious institution	water supply infrastructure
school fire	marine hijacking	thunder storm	emergency staging sites	intrusion sensor	landfill	special needs infrastructure	landfill
smoke	rail incident	tornado	emergency teams	nuclear sensor	pharmaceutical manufacture	adult day care	dam
special needs fire	rail accident	tsunami	emergency water distribution center	radiological sensor	superfund sites NPL	child day care	discharge outfall
wild fire	rail hijacking	bird infestation	emergency food distribution center	agriculture and food infrastructure	toxic release inventory	elder care	ground well
hazardous material incident	vehicle incident	insect infestation	fire suppression operation	college university	educational facilities	telecommunications infrastructure	pumping station
chemical agents	vehicle accident	microbial infestation	fire hydrant	school	energy facilities infrastructure	telecommunications facility	reservoir
corrosive material	vehicle hijacking	reptile infestation	other water supply location	energy facilities infrastructure	generation stations	telecommunications tower	storage tower
hazardous when wet	explosive	rodent infestation	fire station	agricultural laborer	animal feedlots	air traffic control facility	surface water intake
				commercial food distribution center	farms ranches		water treatment facility
				food production center			

\*yellow highlight = symbols changed in latest release, green highlight = new symbols in last release

# Basic Approach



- **Survey use of ANSI symbols and other point symbols across tasks and components within DHS**
  - Interviews (narrow audience)
  - Online survey (wider audience)
- **Develop a repeatable process for creation of symbol standard(s)**
- **Test the process on a selected domain or application area**

# Focus Areas



- **Primary DHS missions of interest**
  - FEMA – primarily Mapping and Analysis Center
  - Customs and Border Protection
  - Coast Guard
  - National Protection and Programs Directorate
  - Infrastructure Information Collection Division
  - National Operations Center
  - Fire Service
- **Plus other federal/state/local parties identified by DHS**

# Interviews



- **Conducted 14 interviews with map producers and users in various DHS missions**
- **Audio recordings for 10, written notes for 4**
- **Formative study using semi-structured format**
- **Question set centered on:**
  - ANSI Standard
  - Critical Incidents Related to Symbology
  - Technical / Organizational Challenges
  - Map Examples Provided by Participants
  - Ideas for New Symbol Standard Process



# Results: ANSI Standard



- **Standard not used by most participants**
  - Only FEMA / IICD use a small subset of the symbols (nobody using the complete set)
- **In general, the reason for lack of use is not technical**
  - Minor problems using fonts, etc... seen as easy to fix
- **Key reason for lack of use is reported lack of match to missions/information customers**
  - Participants only use the symbols from the set that could be considered in common use (hospital “H”, airport, etc...)

# Results: ANSI Standard



- **Many of the symbols are too intricate and difficult to parse without explanation**
  - Especially symbols that attempt to mix together information from a type of event happening to a type of infrastructure
  - One participant suggested it's easier to simply put two symbols next to each other to indicate the type of feature and its current condition
- **The ANSI symbols do not scale well beyond local situations**
- **Participants assume ANSI symbols should work for local responders**

# Results: Key Design Issues



- **Some groups label every symbol put on maps by default, adding to clutter issues**
- **Some groups are taking symbols and applying different meanings apart from the standard**
- **Outline set (damage levels) does not match all mission types, and few data sources provide such details**
- **Different groups assign common colors (red, green, etc...) to conditions that do not match the ANSI standard**
- **No participants are required to design for b/w**

# Symbology Development Process



- **Key issues are organizational, not technical**
  - Must involve all groups that generate and use maps in the process of developing symbols templates
  - Need “buy-in” within and across organizations to mandate the creation and application of standards
  - Need training materials to disseminate standards
- **Developing a single common symbol set is judged to be reasonable only for a small subset of features**
  - E.g., for basic infrastructure that everyone must show

# Symbology Development Process



- **Participants suggest that divisions should develop their own standards and share with others**
- **Multiple web-GIS platforms in development at different DHS components provide point of entry for new standards**
  - It's not hard for them to show things the way they want to see them as long as they have adequate metadata

# Map Example Feedback



- **Many maps are thematic / analytical in nature and symbols must co-exist with a range of additional data**
- **Web mapping tools are becoming more important than printed matter**
  - Systems include iCAV, DHS Earth, eGIS, VirtualUSA
- **Few participants can provide examples of instances in which they needed to transform output media substantially (e.g., to a PDA)**



# New Symbology Process



- **Round 1: Needs Assessment**
- **Round 2: Standard Development**
- **Round 3: Quality Control**
- **Round 4: Implementation**
  
- **Basic Principles**
  - Rely on distributed, asynchronous methods
  - Web-based tools to capture each stage of process
  - Identify which steps should take priority

# Needs Assessment



- **Collect existing symbols & example maps**
- **Web discussion on problems with current symbols + symbol categories**
- **Web discussion to identify & agree on categories for grouping symbols**
- **Create master list of all features that must be included**

# Standard Development



- **Create matrix of features & current symbols**
- **Identify missing symbols and symbols that are used for multiple features**
- **Web-based card sorting exercise to evaluate categories from round 1**
- **Develop symbols that were missing in matrix, vote on symbols used for multiple features**

# Quality Control



- **Send results of round 2 to cartographic experts for review and graphic design**
- **Send results of round 2 to domain experts for review**
- **Revise new standard based on feedback**
- **Web-based card sorting exercise to re-evaluate categories for new symbology**

# Implementation



- **Apply new symbology in tabletop exercise or real work to evaluate its utility**
- **Store new symbology in proposed web-based Symbol Store**
- **Capture user feedback on new symbology through purpose-built mechanisms in proposed Symbol Store**

# Future Work

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- **Pilot new process and refine based on results**
- **Working with CBP for first trial**
- **Pre-package process documentation & tools for future application**



**Thanks for your attention!**



This work is supported by a contract from the U.S. Department of Homeland Security Science and Technology Directorate, Command, Control and Interoperability Division. The views and opinions expressed here are of the authors, and do not reflect the official positions of the Department of Homeland Security or the Federal Government.

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