The Department of Homeland Security (DHS) contains many diverse organizations that produce or use maps to plan for and respond to critical incidents. Audiences for these maps range from geospatial analysts, through organizations that produce or use maps to plan for and respond to critical incidents. The process is divided into four broad phases, with a series of steps to follow:

1. **Survey use of existing map symbols and symbol palettes and use of the existing standard to understand what needs exist.**
2. **Develop a repeatable process for developing, adapting, and sharing map symbology standards.**
3. **Test the process on a selected domain or application.**

Using the input from the interview study with DHS domain experts, we developed a repeatable process for developing, adapting, and sharing map symbology standards.

The purpose of the research sponsored by DHS Science & Technology project is three-fold:

- Survey use of existing map symbols and symbol palettes and use of the existing standard to understand what needs exist.
- Develop a repeatable process for developing, adapting, and sharing map symbology standards.
- Test the process on a selected domain or application.

The four phases in the map symbology specification/standardization process are:

- **Phase #1: Needs Assessment.** The mapping needs of the mission are determined and a set of design guidelines are generated.
- **Phase #2: Specification/Standard Development.** Existing symbols are refined and new symbols are created where necessary.
- **Phase #3: Quality Control.** The symbols are refined by cartographers to improve design consistency across symbols.
- **Phase #4: Implementation.** Generation of symbols in appropriate formats and sharing of symbols with other DHS missions.

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The survey of existing symbology was conducted to survey existing map symbology for critical incidents used within DHS. Fourteen 60-minute interviews were completed with mapmakers and map users at a range of DHS mission areas, including Customs and Border Patrol (CBP), Infrastructure Information Collection Division (IICD), United States Coast Guard (USCG), United States Fire Service (USFS), National Operations Center (NOC), Federal Emergency Management Agency (FEMA), and the Domestic Nuclear Detection Office (DNDO). A total of twenty-one interview questions were developed to cover the following topics: adoption and use of the ANSI standard, the use of other map standards, critical incidents with respect to the use of map symbology, technical/organizational challenges with respect to standard development, and ideas for candidate processes to develop new symbol standards.

The key finding of the research was that it is more realistic for each mission to develop and share their own in-house standard rather than to generate a comprehensive standard for all of DHS. The following recommendations for developing in-house standards were identified from the interviews:

- Symbols must support wide range of mission needs beyond basic emergency response.
- Symbols must support wide range of output formats and map scales.
- Symbols must be as simple as possible to avoid interpretation issues.
- The process of standardization must involve map users as well as mapmakers.
- Symbol categorization can be as important as the symbols themselves.
- The ability to see a map from one’s preferred perspective is important during an emergency.
- In house symbol standards can be used to inform development of new formal standards.
- Organizational structures must be implemented to foster the development and use of symbol standards.

Testing the Process

To test the process, we developed an asynchronous and distributed web-based application that implements a modified Delphi study. We expect the use of distributed, asynchronous methods to improve the application of the symbology development process, as busy professionals are not required to gather in person at the same time. Each phase in the process is implemented as a Delphi round lasting one week, with multiple activities included in each round. Participants offer input and feedback for each activity in the form of individual response to questions, group discussion boards, and/or voting/polling. After a round closes, a moderator summarizes the contributions for use as a jumping-off point in the following round.

A pilot study for the symbology development process is scheduled with Customs and Border Patrol in the month of February, 2010.