

## A PROPOSED NEW WORLD STANDARD FOR HUMANITARIAN DEMINEING MAP SYMBOLS

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### **ABSTRACT**

A new world standard is proposed for cartographic representation of landmines, minefields, and mine actions (e.g., mine risk education, technical survey, clearances). Currently, there is no standard, and great disparity exists even among neighboring countries where landmines are common. The proposed standard, recently developed for the Geneva International Centre for Humanitarian Demining (GICHD) by geographers at the University of Kansas, certainly will be employed by operational demining programs throughout the world, but GICHD would also like to see it adopted by mapping agencies, GIS vendors, and nongovernmental organizations (NGOs). To promulgate the new standard, the American Geographical Society held workshops in New York, New York, and Reston, Virginia. Both workshops had a good presence of international organizations such as the United Nations, private firms such as ESRI, and NGOs such as the Vietnam Veterans of America Foundation (VVAFA). The enthusiasm shown by workshop attendees bodes well for a future global standard.

### **INTRODUCTION**

Today, civilian populations in over eighty countries around the world are affected by landmines and other unexploded ordnances (UXOs). The Geneva International Centre for Humanitarian Demining (GICHD) estimates that approximately 40 – 50 million active landmines are currently in the ground worldwide [1]. The goal of humanitarian demining operations is to remove these hazards and return the cleared land to civilians and local governments. The GICHD supports humanitarian demining efforts by providing operational assistance to mine affected countries, initiating research and development projects, and supporting implementation of the Anti-Personnel Mine Ban and the Ottawa Convention.

Geographic Information Systems (GIS) are crucial in humanitarian demining for the management, analysis, and display of geospatial data that are necessary for safe and efficient mine action operations (e.g., mine risk education, technical survey, clearances). The GICHD develops and distributes the Information Management System for Mine Action (IMSMA), the leading information system and GIS for the collection, storage, and mapping of information for minefields and mine actions. IMSMA is deployed in more than forty countries,

accounting for over 80% of the humanitarian demining programs worldwide [1]. The United Nations endorses IMSMA as the preferred information system for mine action operations [2]. The current version of IMSMA (4.0) includes mapping and analysis functionality developed with ESRI's ArcGIS Engine, and is currently in the initial deployment stages following field testing in Burundi, Colombia, Jordan, Kosovo, and Uganda.

## **CARTOGRAPHIC SYMBOLS FOR HUMANITARIAN DEMINING**

GIS-based systems such as IMSMA are incorporated into humanitarian demining for a variety of mapping purposes. For example, general maps of landmine hazards are produced for civilians in mined regions. Maps of specific demining information, such as the status of various mine action operations or the types of ordnances in a minefield, are necessary to assist personnel in the clearance process. As such, a broad set of cartographic symbols is necessary to depict the many categories of landmine hazards and mine actions on maps for various audiences.

Currently, there is no international standard for humanitarian demining map symbols. The International Mine Action Standards (IMAS) [3], which provide specifications for many aspects of humanitarian demining, do not specify specific symbols for use on maps. In the absence of a formal standard, cartographic symbols used by demining programs in neighboring countries (e.g., Albania, Bosnia-Herzegovina, and Croatia) often vary considerably. However, an international standard for cartographic symbols would provide numerous benefits in humanitarian demining, including improved safety and efficiency in operations.

## **A PROPOSED STANDARD FOR HUMANITARIAN DEMINING MAP SYMBOLS**

Due to the lack of an international standard, the GICHD recently contracted geographers at the University of Kansas to devise a humanitarian demining map symbol set that could be implemented in IMSMA and promoted as a standard in the demining community as well as to major mapping agencies and GIS vendors. The proposed standard recently has been implemented in IMSMA 4.0, and includes over 150 point, line, and polygon symbols for categories such as hazards (e.g., minefields, mined areas), mine action

operations (e.g., hazard reduction, mine risk education), accidents, victims, and places (Figure 1). The symbol set is available from the GICHD and the paper authors as an ESRI style (.style) file and two True-Type (.ttf) fonts.

A number of factors were considered in the design of the humanitarian demining symbol set. Key criteria that guided development include the following:

1) *Landmine, minefield, and other hazard symbols were designed to imply danger.*

Since the penalty for misreading cartographic symbols may result in deadly consequences, it is critical that hazard symbols on humanitarian demining maps clearly imply danger. For this reason, all hazard symbols include a red triangle, the international standard for minefield marker signs as specified in the IMAS [4].

2) *Intuitive, pictorial symbols were designed whenever possible.*

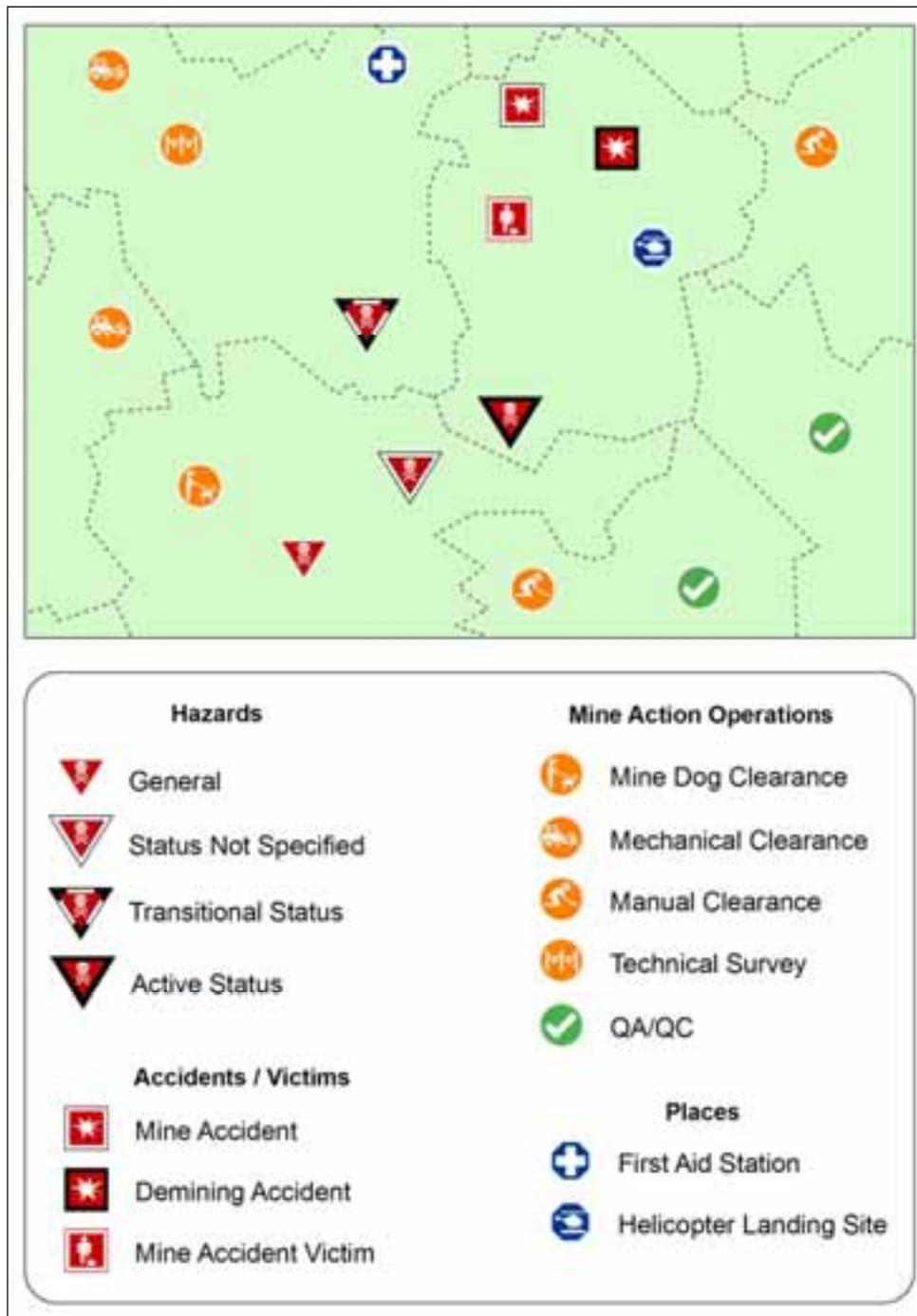
Intuitive, pictorial symbols were designed since maps created in IMSMA are used by those from several cultures and different levels of education and expertise. An advantage of pictorial symbols is that they are easier to understand than abstract symbols and are appropriate for the general public [5]. Pictorial symbols, such as an icon of a skull and crossbones to depict a minefield and an icon of a demining worker to represent manual clearance, were designed to cross cultural boundaries and various levels of expertise.

3) *Symbols were designed to display either general or specific information in a logical manner.*

Map symbols for IMSMA were organized into a hierarchical or tiered structure to allow for easy display of general or specific information. For example, a red triangle is the general symbol for a hazard. An icon added to the red triangle depicts the type of hazard (e.g., dangerous area, mined area, minefield) and a border added to the symbol denotes the status of the hazard (e.g., active, expired, not specified).

4) *Appropriate colors were selected for symbols.*

Color has different meanings and connotations between cultures, which poses a challenge in the selection of colors for humanitarian demining map symbols



**Figure 1.** Examples of point symbols included in the humanitarian demining symbol set in IMSMA.

that indicate danger or safety. For this reason, safety color codes for public signs issued by the International Organization for Standardization (ISO) [6] (red = prohibited, yellow = caution, danger, blue or green = safety) were adopted for all symbols. In addition, color schemes that are friendly to those with color vision impairments recommended by Brewer, Hatchard, and Harrower [7] were also selected.

5) *Symbols were designed to photocopy or print in black and white.*

Since color printing capabilities are not available for all IMSMA users, particularly in demining field offices, color is used for added emphasis for all symbols and other graphic attributes (e.g., border, icon, size) are employed to ensure that symbols may be differentiated when printed or photocopied in black and white.

6) *Symbols adhere to existing standardized symbols as feasible.*

Standardized symbols from both NATO's *APP-6A: Military Symbols for Land Based Systems* [8] and the "Homeland Security Mapping Standard—Point Symbology for Emergency Management" project by the U. S. Homeland Security Working Group [9] were integrated into the humanitarian demining symbol set.

## **PROMULGATION OF HUMANITARIAN DEMINING MAP SYMBOLS**

The American Geographical Society (AGS), in conjunction with the GICHD, recently organized two workshops to promulgate the new humanitarian demining symbology. One goal of the promulgation effort is to draw attention to the necessity for an international standard for map symbols used in humanitarian demining. One workshop was held in New York, NY and the other at the U. S. Geological (USGS) headquarters in Reston, VA. Workshop attendees included representatives from the UN, nongovernmental organizations (NGOs) (e.g., Vietnam Veterans of American Foundation (VVAF)), private firms (e.g., ESRI), and U. S. federal agencies (e.g., Census Bureau, National Geospatial-Intelligence Agency (NGA), USGS). Several workshop attendees pledged their support for the establishment of an international standard, which bodes well for future promulgation efforts to standards organizations. Of the many benefits of standardized symbols for

humanitarian demining maps, the greatest is to improve safety for civilians in mine affected regions and those dedicated to clearing landmine hazards.

## **ACKNOWLEDGEMENTS**

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