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The Bosnia and Herzegovina Mine Action Information System

Zoran Grujic
Bosnia and Herzegovina Mine Action Centre

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comprehensive knowledge to inform strategic decisions, coordination and prioritization of the high-risk tasks. The initial configurations performed on the system and the data quality itself will help fulfill the overall objective of efficient land release.

While IMSMA™ can effectively support land-release information management, it should remain clear that it is effective management of information that is fundamental to support land release. See endnotes page 81

Daniel Eriksson, Ph.D., is Head of the Information Management section at the GICHD. Eriksson was introduced to mine action during the Swedish military service as an explosive ordnance disposal specialist. After completing his mandatory service in 1993, he was involved in research and implementation of information management and decision support systems in Afghanistan, Iraq and Sudan. He has employed pilots including the Swedish Rescue Services Agency, the European Commission, United Nations Office for Project Services and Vietnam Veterans of America Foundation Information Management and Mine Action Programs.

Daniel Eriksson, Ph.D.
Section Head, Information Management
Geneva International Centre for Humanitarian Demining
Tel: +41 22 906 1655
E-mail: d.eriksson@gichd.org

Aurora Martinez provides support to mine-action programs using IMISMA™ and works on the development of information-management publications and course curricula. Martinez joined the Geneva International Centre for Humanitarian Demining in 2008. She previously acted as the GICHD’s Outreach Officer for the implementation of a communications plan. She holds a master’s degree in economics and social history from the University of Geneva, and completed a two-year program at Geneva’s Graduate Institute of Development Studies.

Aurora Martinez
IMISMA™ Support Officer
Geneva International Centre for Humanitarian Demining
Avenue de la Paix 7bis
CH-1211 Geneva / Switzerland
Tel: +41 022 906 1655
Fax: +41 022 906 1650
E-mail: a.martinez@gichd.org
Website: http://gichd.org

T he life and blood of a mine-action program is the information system. It is one of the most critical, yet frequently used mine-action tools. The Bosnia and Herzegovina (BiH) mine-action information system program, originally called “The Database,” started in 1996. At the time, Microsoft® Windows® 3.1 made networking simple and a must, but the geographic information systems that were available created a challenge for information-systems teams.

The BiH team was tasked with developing a network-based information system that could handle scanned images. In addition, there was a need to create standard database operations and provide abilities to use SQL statements (relational queries). Last but not least, the system would need real GIS capabilities to make accurate, quality and clearly readable maps in less than 20 minutes from the request time.

The data workload was described by the Annex 1A, Chapter 4, Parts 1 and 2 of the Dayton Peace Accords, forcing former warring factions to remove minefields and submit their data on remaining minefields and booby traps. The deadline was short, so the system needed preparation and full operation from Day One.

It was immediately clear that BiH had no indigenous resources that could cope with the problem; therefore, help was requested from the international community during the London Peace Implementation Conference. The international community agreed to support the effort and program implementation began in March 1996. The U.S. Department of State funded two contractors that were tasked with various assignments. Infrastructure creation and staffing were assigned to RONCO Consulting Corporation, a leading international demining company, and database creation was tasked to FGM, Inc., an information-technology company from Washington, D.C. (U.S.).

Initial Configuration

The problem had been identified; the experts were in place to provide staffing and infrastructure, and U.N. Department of Peacekeeping Operations provided the software.

At the time, the database-management system was the U.N. preferred Borland Paradox® and the recommended GIS software was MapInfo®. That software combination shaped the entire Bosnia and Herzegovina Mine Action Information System’s existence.

Paradox proved to be a good system for networking a database and the program language was simple enough for new database administrators/programmers to learn in less than a week. The database continues to use Paradox (version 11) today, but the program has had many upgrades and has evolved into a more sophisticated information system.

The other half of the “software marriage,” MapInfo, proved to be an excellent tool for mapping and cartography in general. In the beginning, the Geographical Section General Staff of the British War Office provided a gazetteer, which provided basic conditions for spatial queries. Paradigm 11 and MapInfo 10 continue to work well together.

Initial Challenges

According to their obligations prescribed by the Dayton Peace Accords, former warring factions provided more than 16,000 minefield reports to NATO implementation task forces. Data were entered and submitted to BHMAC (then known as UNMAG), together with some 1,100 mine incident data reports also entered into the database and charted on GIS. The puzzle became more complex on a daily basis. At the time, procedures for de-mining were mostly unclear. The peculiarity of BiH’s

by Zoran Grujic (Bosnia and Herzegovina Mine Action Center)
Centralization

The information system’s initial structure was created primarily around minefield data and incident data. As program development progressed, the database became more complicated.

The database was centralized. The entire data-entry process was completed and housed in Sarajevo headquarters on 10 networked computers. The server ran on the Windows NT 3.5 operating system—the best that was available at the time.

Expanding Statewide

After 1998, the information system and all assets for demining activities at the state level was handed over to BHMAC headquarters. Foremost was the request for the demining activities at the state level to be handled by the Mine Action Centre of Republic of Srpska, which began keeping data for its territory.

1. The Sarajevo location, which received an additional server for the Federation of Bosnia and Herzegovina Mine Action Center data.
2. The BHMAC headquarters, which kept a consolidated database for the entire state.
3. Scanned images were also divided among these centers and program priorities were shifted from emergency response to planned mine action.

A request for action initiated the process. At that time, the program was based on emergency response; therefore, exceptional request tracking and the ability to respond quickly was essential. The system used contamination information (minefield and incident data), and a General Survey was the main action. Following the assessment, the task order was issued and clearance was completed. All these aspects were also presentable on maps.

As soon as demining activities started, a dilemma appeared. Geographic Section General Staff maps Series M709 in 1:50,000 scale were up-to-date but useless, as they were not available to the warring factions during the conflict. As a result, ground features referenced on minefield reports were not identically described. In addition, the elevation points did not have the same heights as shown on maps used during the conflict. The only solution was scanning all Yugoslavian Army maps and registering them as future reference material. Consequently, the first and the most important lesson learned was that information systems must be able to use the same raster backdrops as the military forces use during the conflict.

Initial construction as of August 1997 can be described with the few squares and lines as shown above in Figure 1. In the beginning, the idea was to stress simplicity of structure; the entire system was actually a tasking mechanism, using minefield reports and incident data to determine where to demine and what basic abilities were needed to enter demined areas. A lot of modules added later were not even conceived when it was first constructed.

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The system's previous generation is shown within the rounded square in Figure 3. All system elements are interacting; the database is level 3 normalized, meaning the database's logical design has been improved to avoid data duplication. Yet again, data modeling proved to be the cutting edge of the system. Procedures were then amended as needed once the basic layout was constructed. As a result, the information system followed thereafter.

Slowly but surely the system grew and became more complex. At this stage, the system comprised of around 450 tables, 250 forms and more than 400 reports. The mapping function contained BH 1:1,000,000, 1,300,000, 1,200,000, 1,000,000, 1,500,000, 630,000, 1,500,000 Defense Mapping Agency, 1:50,000 Yugoslav People's Army (JNA), 1:25,000 JNA and targeted areas 1:10,000, 1:5,000, 1:2,500 and 1:1,000. The system contains vector data describing all aspects of mine-action activities in BH.

At this time, the system network was also improved. In the beginning, Sarajevo headquarters was connected to the Internet at 128/128 KB speed. In Phase 2, the network speed was increased to 1 MB/1 MB and regional offices were connected to the Internet at a lower speed. In Phase 3, all regional offices were connected to a virtual private network using Cisco ASA, and the data were updated daily. Current performances are as follows:

- Sarajevo and Banja Luka nodes are in full replication and updated daily.
- Regional offices, excluding Banja Luka and Sarajevo, are updated daily or on demand.
- All locations have wired network 100 Base-T and Internet access 24 hours a day, seven days a week.
- Differential GPS is the standard measuring/reporting tool. Points acquired are uploaded into the system so that nothing has to be hand typed; therefore, errors are minimal.
- Cadastral mapping is the standard backend for reporting since differential GPS is in effect.

- All other maps are now used for planning and wider area analysis.

The Program's Future

The BHMAC program has evolved to a point that realtime database management is needed. That said, Paradex struggles to meet the current demands. Mapinfo might also have difficulties processing a huge data amount through a complex network. Therefore, retuning the old software combination and upgrading to a new database system is necessary. Figure 4 shows the new information-system structure. The system uses an Oracle application using a custom-made GIS application. The initial activities began in March 2009, and the system is currently in its final development phase.

The database relations and data complexity will remain much the same as they were. Mapping backdrops will be preserved, and a new layer of data, utilizing full vector coverage at 1:25,000 scale, will be implemented. The system will use digital elevation data, making 3-D mapping possible. Mapinfo will remain the main cartographic software, and the entire interface will be Internet-accessible, keeping data security in mind.

Currently, the system is in its final deployment phase, and expected implementation is sometime during this demining season.