

T-AI DSS module for analytical assesment of MIS data

Cedo Mati¹, Davor Laura¹, Andrija Krtalic²

Abstract

The crucial document for the success of T-AI DSS application is the analytical assessment of the suspected hazardous area (SHA) based on data and information that are available in MIS of MACs. The outcomes of this analysis are the general and specific requirements for the airborne and space borne collecting and producing new, additional data, information and evidences about the former situation in SHA. The requirement for improvement of this module implies the determination of general guidelines for the implementation of this analysis in any MAC's of mine-affected countries. According to this requirement, within this T-AI DSS's module, general guidelines for conducting of the analytical assessment for better definition of the SHA and the definition of general and specific requirements for the collection of additional data (with T-AI DSS) for better re-definition of the SHA have been developed.

1. Introduction

T-AI DSS is a tool to support decision about the status of SHA. The input includes data from mine information system (MIS), expert knowledge, airborne and satellite data, contextual data, etc. The outcomes are detected and proved positions of indicators of mine presence (IMP) in space, reconstruction of battlefield (in time and space), better (re)definition of SHA, proposals for exclusion from or inclusion in the SHA (thematic maps). The requirement for improvement analytical assessment of (MIS) data module of T-AI DSS refers to the need to determine the general guidelines for the implementation of this analysis in any MAC's of mine-affected countries. Due to this requirement, general guidelines for conducting of the analytical assessment for better definition of the SHA and the definition of general and specific requirements for the collection of additional data (with T-AI DSS) for better re-definition of the SHA should be developed within this T-AI DSS's module. Another requirement for the research within the scope of this module is the need to develop simplified version of the T-AI DSS (without the airborne multisensor acquisition and satellite images) that can be used in MAC's for the support of the SHA assessment, reduction, re-categorisation and inclusion, only with indicators of mine presence and mine absence derived from MIS data and MAC's standard operational procedures.

2. Analytical assasment

Analytical assessment for the process of collecting additional data on a SHA consists of an in-depth comprehensive analysis and interpretation of all previously collected data stored in the MIS. Furthermore, analytical assessment is a basic stage in the processes of technical and non-technical surveys of SHA. Primary goal of analytical preparation is spatial positioning and contextual interpretation of all the data stored in the MIS. This makes a strong analytical basis for identifying general and special requirements for collecting data on SHA which are missing in the MIS. Analytical assessment and its results (general and special requirements) are desirable preconditions for high quality usage of AI DSS in humanitarian demining.

The results of analytical assessment should provide:

- Assessment of the condition of the SHA based on existing data,
- Assessment of rough boundaries of the SHA within which data will be collected, and
- Requirements for data collection in the field.

Mine action experience in the Republic of Croatia and Bosnia and Herzegovina has shown that minefield records and other fundamental documents about minefield laying do not provide complete and precise data which would enable to determine realistic condition of the SHA. In specific war-time conditions, mine laying documents were not always made, existing documents are incomplete or imprecise, some have been lost or destroyed during the war, and some of them are probably still unavailable. This is why all available data related to mine laying should be researched through analytical assessment, in a systematic way, in order to make up for the lack of original mine laying documents.

¹ Croatian Mine Action Center, Croatia, cedo.matic@hcr.hr, davor.laura@hcr.hr

² Faculty of Geodesy University of Zagreb, Croatia, kandrija@gmail.com

Due to the fact that original mine laying documents are missing or they have not been made at all for certain areas, SHA assessment must be focused on the research of the way in which the war was fought, on the history of military activities during the war and on reconstruction of the battlefield. In such conditions, research of consistency of military activities, terrain characteristics and engineer support of combat operations, is of utmost importance in achieving an optimal assessment of the SHA condition.

Analytical assessment comprises the following procedures: investigation of existing data and phenomena, examination of their content, comparison, systematization and gradual integration according to military activities and order of battle in a certain area. In doing so, it is important to explore the chronology of military activities during the war, with a special emphasis on relocations of units and other indicators of organization and implementation of defensive and offensive activities that influenced the construction of barrier minefields.

The experience from the Homeland War in the Republic of Croatia (1991-1995) and Bosnia and Herzegovina has shown frequent cases of shifting of defensive lines and positions (temporal component in analyzing the condition of the SHA), introduction of new units into the existent order of battle, certain *overlap* of areas of responsibility of the units in new situations on the battlefield, or of taking over the positions of the opposing side. Such cases can make the mine contamination situation more complicated. They require serious analytical work through the process of preparing for collection of data in the field.

2.1 The tasks of the analytical assessment

In order to understand the working process better and to implement the process in a more efficient way, the tasks of the analytical preparation for collection of additional data may be conditionally divided into three groups:

1. Individual analysis of existing data, entering the data into the MIS, reliability assessment of the positions shown on GIS maps (a part of MIS containing geographical and geodetic bases used for entering end positioning data in the MIS) and defining of requirements for data collection in the field.
2. Integration of existing data into the system of organization of defensive and offensive activities of the units, improvement of the results shown on GIS maps and definition of requirements for data collection in the field.
3. Analytical assessment of the initial SHA state, with a list of requirements for collection of additional data about the terrain.

The first phase of the process of analytical preparation for collection of additional data about SHA is the analysis of existing MIS data. The tasks of analytical preparation of the existing data comprise the following:

- detailed individual analysis,
- comparison and linking of data,
- spatial positioning (on GIS maps),
- entering (storing) into MIS and
- gradual interpreting according to dynamics of fighting and disposition of units on the battlefield.

In order to fulfil the tasks of analytical preparation, suitable GIS maps are needed that will allow marking of geospatial data as accurately as possible. Different symbols, colours, cross-hatches and other signs should be used in data presentation, in order to ensure that the data, functional ownerships and mutual relationships of the elements inside a system of organization of the defence of the units are clearly shown.

Through analytical assessment, additional data for MIS are created. In order to enter (store) the data obtained by analytical preparation, it is necessary to create adequate overviews in form of vectors and tables. Through final integration of all available data, these overviews will enable detection of new indicators of constructing barrier minefields in certain areas. That is to say that it is necessary to determine positions of all material or contextual data about barrier minefields (obtained by analytical preparation), as precisely and as accurately as possible, on GIS maps, and store them in MIS, in form of a symbol, a line or a polygon.

The overview of analytical assessment tasks comprises data which in practice can appear as existing data or mine contamination indicators in the system of organization of disposition of units in defensive and offensive activities.

2.2 Significant factors for analytical assessment

The analysis of the following factors has significant impact on fighting characteristics:

- Area (type of terrain) where the fighting takes place,
- Time when the fighting takes place,
- Combat capability of the opposing troops,
- Level of technical equipping of the opposing sides,
- Force and equipment usage skills.

Analytical assessment for collection of additional data about SHA is a process in which we should analyze all existing data individually, present the data, as precisely as possible on GIS maps and store the data in MIS; identify their connections through integration according to chronological order of military activities and create an analytical assessment of the condition of the SHA. At the same time, through the process of analysis, we identify missing data which should be collected for better assessment/definition of the existing SHA assessment. In this way, analytical assessment represents the basis for collection of additional data about mine contamination situation in specific areas.

The given concept of analytical assessment presumes that, when making an assessment, it is necessary to detect the cause and effect connections between mine laying and the course of military activities. Analyzing and integrating available data, it is necessary to reconstruct the laying of minefields resulting from war-time military activities, and disposition of units on the battlefield.

2.3 Basic activities in the analytical process

Investigation and analysis of available data, spatial representation of data on GIS maps and storing in MIS, are basic activities in the analytical process of assessing/defining the SHA. In general, these activities are conducted through continuous work, i.e. continuous redefining of SHA is conducted on the basis of newly collected data.

Specific information tools are created for storing the data, in order to enhance efficiency of data comparison, their integration and establishment of links between construction of minefields and disposition of units in a specific phase of military activities. The area of analytical work is a rough area which requires to make analytical assessment of the SHA and to define requirements for collection of additional data.

A rough area may be:

- the overall area covered by war-time military activities for the purpose of creating the initial assessment of the condition of SHA for mine action purposes,
- areas that were not fully researched through previous data collection activities, i.e. areas with imprecise and insufficient indicators of the SHA condition,
- areas expected to meet conditions for exclusion of certain areas and buildings from the SHA,
- areas planned for humanitarian demining, so that development of demining projects can be as precise and of highest possible quality.

The borders of the area which is to be analyzed are harmonized with the order of battle of both conflicting sides and organizational military units which were active in the area.

3. Conclusion

The above presented procedures define important indicators of the condition of SHA, so that the mine action system in any given moment may have relevant data for efficient planning and organization of humanitarian demining activities. The results of the overall analytical work will greatly depend on expert military knowledge, skills and affinities of the members of analytic teams of researchers. The main results (for T-AI DSS usage) of analytical assessment are definition of general and special requirements for collection of additional data with T-AI DSS. Someone should assess the possibility to use T-AI DSS for collection and processing of all available data (MIS data and additionally collected data).

4. Acknowledgement

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2012-2013) under grant agreement n° 284747, project TIRAMISU.