Levels of dana within AI DSS

Andrija Krtalic, kandrija@gmail.com
Introduction

- Mine clearance and reduction of SHA are complementary actions in the process of removing the mines in Croatia.

- Reduction of SHA in Croatia is carried out with the help of AI DSS.

- The system analyzes and processes all available and comparable information, data and expert knowledge of the mine scene.

- The quality of acquired images by AI DSS depends on the indicators that are looking at the scene.

- Due to the reduction of risk and lack of information from the depths of the MSA, its boundaries are defined in the larger areas than it takes in reality.
Minefield Information Systems
Data

- CROMAC MIS is the unique information system.
- System adjusted to CROMAC activities.
- MIS is dynamic system which reflects the actual CROMAC's needs and goals.
- Therefore it should be continuously updated.
Minefield Information Systems
Data - 2

- This MIS consist of following data:
  ◦ minefield records data;
  ◦ mine incidents;
  ◦ digital orthophotos (DOP) with scale of 1:5000 (DOP5) and 1:2000 (DOP2);
  ◦ maps (with scale of 1:5000 (Croatian Base Map (CBM)), 1:25000, 1:50000, 1:100000);
  ◦ data from military working maps;
  ◦ vectorized SHA;
  ◦ vectorized areas for general and technical survey, vectorized results of general and technical survey.

- This data are used for preparing and making of demining project documentation.
- DOP5 are panchromatic, contain data from the time period 1999-2001.

- They were useful in the initial phase in 2008 for the search of the indicators.

- The color DOP2 show the situation in 2006 but only inside the strictly defined SHA.

- Additional information was derived for certain class of the indicators.
Display of the same area with vectorized SHA on CBM with scale of 1:5000 (left), and on DOP with the same scale.
The demolished houses from 1999 – 2001 (a) were reconstructed in 2006 (b).
Advanced Intelligence Decision Support System

- Reduction of SHA in Croatia is carried out with the help of Advanced Intelligence Decision Support System (AI DSS).

- The system was used for acquisition images and data over the SHA.

- The AI DSS was developed as a complete system, that contains:
  - airborne multisensor acquisition subsystem (visible, infrared, thermal, hyperspectral),
  - the interpretation subsystem,
  - the trained team of operators and interpreters,
  - and the general standard operation procedures.
Airborne multisensor acquisition system and images

- The system was used for acquisition images and data over the SHA.

- These images and data were collected with aim to enable reliable detection of the indicators of mine presence and the indicators of mine absence.

- The image resolution is determined by the size of indicators.

- Using raw images the mine field indicators were detected and their locations were accurately defined on the maps or on the digital ortho photo maps.
Airborne multisensor acquisition system and images - 2

Strong indicators of mine presence (threnches and shelter for heavy weapons) and indicator of mine absence (area in use) within SHA on image of MS3100 camera.
Other sources of images and data

- The public (Google Earth) and commercial satellite images were very useful source for wider view of the considered areas.

- Data contained in these images have date of the acquisition and provide additional information (time domain) about the considered scene.

- The very significant levels of data are also:
  ◦ contextual information,
  ◦ expert knowledge and
  ◦ results of the fusion of all available data.
Other sources of images and dana - 2

The long linear trench is visible very clearly in the satellite image (Google Earth) from 2006.
Other sources of images and dana - 3

- Contextual data are linked with type of the terrain.

- For example,
  ◦ in the swampy areas, it is important to know the water level during the years of conflict.
  ◦ in the mountainous areas it is important to know the slope.

- Based on these data someone can produce the prediction models of areas which are not contaminated with mines.

- The expert knowledge connect the indicators and their impact on the environment and each other.
Other sources of images and dana - 4

a) White areas, inside pink polygons ((for search) at the ridge of a mountain Velebit, shown for 35 degrees of terrain slopes. b) The frequency of the water levels from 1991 to 1995 at Tikveš in Kopački rit (Bilje, Croatia).
Conclusion

- CROMAC MIS is a dynamic information system which reflects the actual CROMAC's need and goals.
- It should be continuously reviewed and updated.
- AI DSS is designed for this purpose.
- AI DSS displays the current state of the SHA.
- The main contribution of AI-DSS is a formalization of expert knowledge and production of various thematic maps.
- This thematics maps are used as decision support in mine action in terms of reduction of the SHA.
Questions?