

**TIRAMISU**

# Levels of dana within AI DSS

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# Introduction

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- 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

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- 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

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- This MIS consist of folowing data:
  - minefield records data;
  - mine incidents;
  - digital orhophotos (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 using for preparing and makeing of demining project documentation.

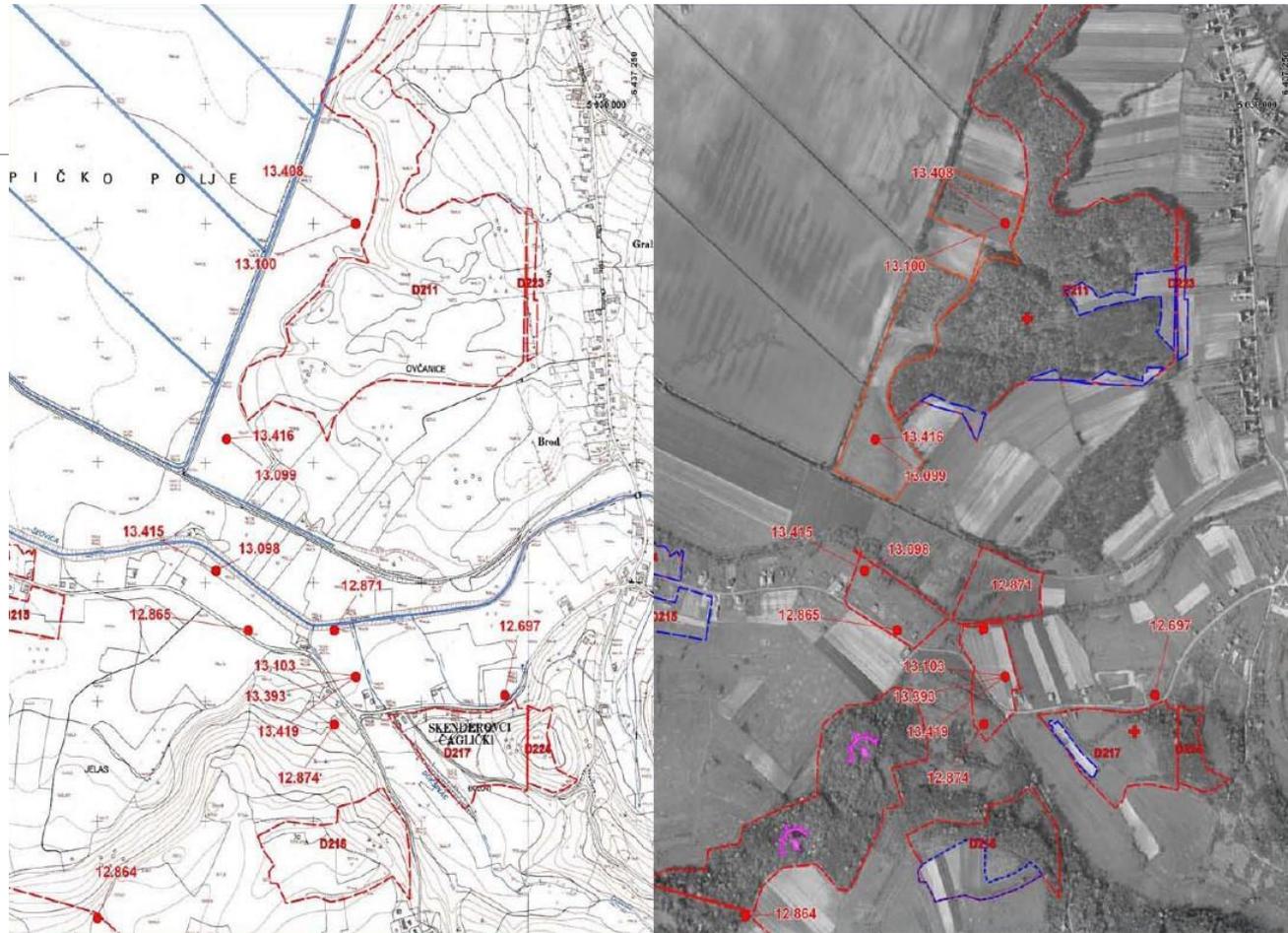
# Minefield Information Systems

## Data - 3

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- 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.

# Minefield Information Systems Data - 4



*Display of the same area with vectorized SHA on CBM with scale of 1:5000 (left), and on DOP with the same scale.*

# Minefield Information Systems Data - 5

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a



b

*The demolished houses from 1999 – 2001(a) were reconstructed in 2006 (b).*

# Advanced Intelligence Decision Support System

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- 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

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- 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 (trenches 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

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- 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 data - 2

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*The long linear trench is visible very clearly in the satellite image (Google Earth) from 2006.*

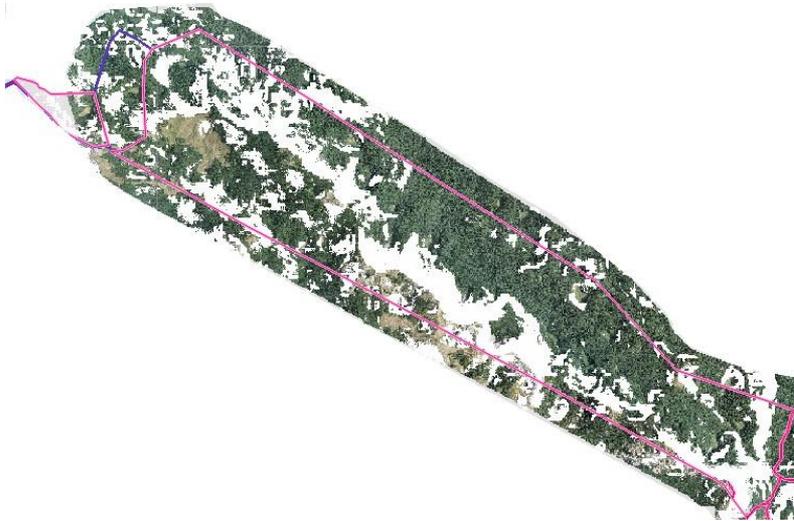
# Other sources of images and data - 3

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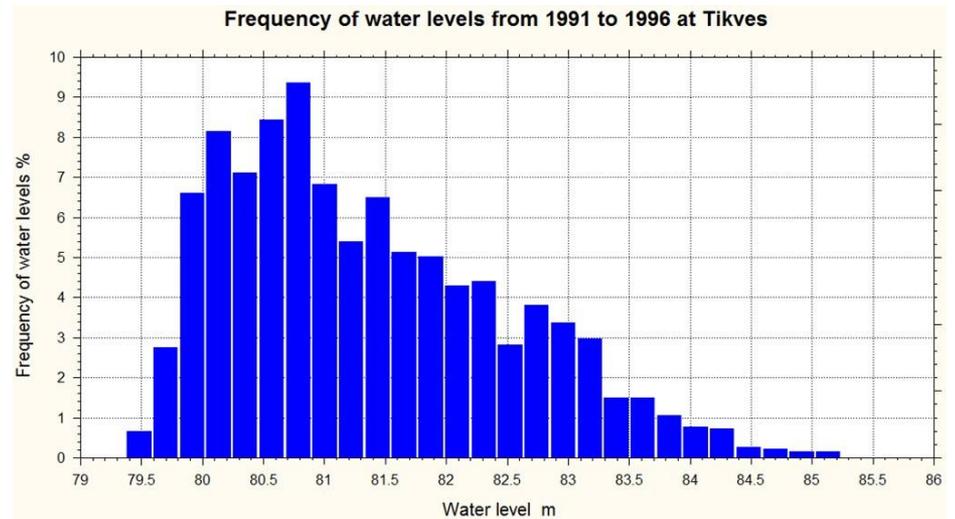
- Contextual data are linked with type of the terrain.
- For example,
  - in the swampy areas, it is important to know the water level during the years of conflict.
  - in the mountainous areas it is important to know the slope.
- Based on these data someone can produce the prediction models of areas 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

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a



b

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

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- 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 thematic maps are used as decision support in mine action in terms of reduction of the SHA.

# Questions?

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