TIRAMISU

Toolbox Implementation for Removal
of Anti-personnel Mines, Submunitions and Uxo

UPGRADE OF THE ADVANCED INTELLIGENCE DECISION SUPPORT SYSTEM FOR MINE ACTION IN PROJECT TIRAMISU

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COLLABORATORS ON THE PROJECT TIRAMISU

- These are people who have participated so far in these activities on a project TIRAMISU (for CTDT or FGUNIZ, in alphabetical order):
  - **Milan Bajic, Igor Buneta, Zlatko Candjar, Tomislav Ciceli, Dubravko Gajski, Mateo Gasparovic, Hrvoje Gold, Cedomil Gros, Tamara Ivelja, Tihomir Kicimbaci, Marko Krajnovic, Andrija Krtalic, Davor Laura, Martin Loncaric, Cedo Matic, Ivan Racetin, Luka Valozic, Dejan Vuletic.**

INTRODUCTION

- Reduction of the suspected hazardous areas (SHA) is a long lasting and expensive process.
- That require collecting additional information from the depths of the SHA.
- There was a need for a new tool designed to assist the experts and managers in their decisions.

INTRODUCTION 2

- To fulfil this need, the Advanced intelligence decision support system **(AI DSS)** was developed and operationally implemented by the Faculty of Geodesy of the University of Zagreb (FGUNIZ) and the CROMAC Centre for Testing, Development and Training Ltd. (CTDT), starting from the generic methodology of SMART and new developments and advancement supported by the Croatian Ministry of Science.

THE AIM OF AI DSS

- The aim of AI DSS is to:
  - support decision making about the SHA,
  - enable reliable assessment of the SHA,
  - propose areas that could be excluded from the SHA,
  - define areas that are suspected but never have been considered as suspected,
  - change categories of SHA,
- All this without deminers' entering into the SHA.

THE AI DSS IS AN OPERATIONAL SYSTEM, BUT...

- The AI DSS is an operational system that already was used and yielding good results in Croatia and it has also been used with success in Bosnia and Herzegovina.
- But, during these projects, certain disadvantages and limitations of the current system have been noted.

USER NEEDS AND REQUIREMENTS

- Experts in mine action derived general and special **requirements** and **needs** for collecting mising data through the implementation of AI DSS.
- On the basis of these **disadvantages**, **limitations** and defined user **needs** and **requirements**, requirements for the needed upgraded design was defined and elaborated thoroughly in D220.1_v2.

ELABORATION, REGUIREMENTS, RESEARCH

- Detailed elaboration of the requirements and the beginning of the study were conducted in the first year of the project.
- Further research should be conducted in terms of upgrading existing operating AI DSS.
- The gaps within the existing AI DSS were noted and the requirements for the research defined.
- Results of this research will eliminate these gaps and improve them.

REQUIREMENTS

- The 21 requirements, for filling the gaps, were defined and described in D.220.1.
- Types of this requirements are:
  - Tehnical,
  - Methodological and
  - Other.

TEHNICAL REQUIREMENTS

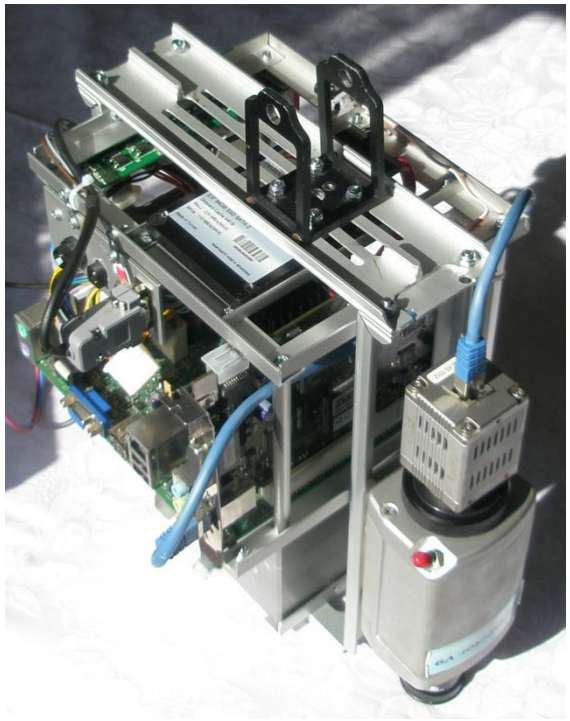
- Technical requirements were related to:
  - finding suitable types of platforms for T-AI DSS,
  - advancement and re-designing of airborne equipment,
  - stable electricity supply for the system,
  - securing a stable GPS signal, without losing the connection,
  - hardware and software limitation for parametric georeferencing of the hyperspectral (cubes) data.

- The aim of the research, for this matter, is relate to increasing the robustness and stability of the AI DSS components.
- The robustness of airborne multi sensor imagery acquisition sub-system of existing AI DSS is increased by:
  - replacing of the existing acquisition (desktop) computer with the industrial (computers) controllers,
  - producing a new electric power supply for it.

BLIMP PLATFORM

- A study on the possibility of setting up and using the **smaller system** for aerial hyperspectral data acquisition on the **blimp** was carried out.
- Smaller system for aerial data collection (due to the small payload capacity of the blimp) is designed and constructed for this purpose.
- The test flights indicate that the blimp is suitable, in certain circumstances, for hiperspetralna survey.

BLIMP PLATFORM



Small system for aerial hyperspectral data acquisition.

Small system for aerial hyperspectral data acquisition on the blimp (in green elipse).

HARDWARE AND SOFTWARE LIMITATIONS

- Hardware and software limitation of capacity and functionalities for parametric georeferencing of the hyperspectral (cubes) data are solved by purchasing and using the:
  - new version of software and
  - stronger processor in computer with larger RAM.

METHODOLOGICAL REQUIREMENTS

- Methodological requirements were related to:
  - developing the airborne hyper-spectral mine field assessment technology, that should be approved by research and validation,
  - developing the general airborne hyperspectral survey of the area in and out the exploded ammunition storage as new functionality for T-AI DSS (for getting new indicator of mine presence (possibly)),
  - the interactive semi-automatic methods of the detection and extraction of the "'strong" indicators of the mine presence,

METHODOLOGICAL REQUIREMENTS 2

- Methodological requirements were related to:
  - advancement of data fusion within DSS sub-system of T-AI DSS (finding a new method),
  - analytical assessment of data from MIS to obtain general and specific requirements for providing additional data of SHA,
  - researching and developing of the operational calibration methods.

DETECTING THE DEBRIS AND UXOS RESULTING FROM EXPLOSION OF AMMUNITION DEPOTS

- Air data collection was not originally planned for the first year of the project.
- However, additional activity: detecting the debris and UXOs resulting from explosion of ammunition depots has changed the plan and priorities for the first year of the project.
- The work on this task has been a major priority for CTDT and FGUNIZ in 2012.
- So, the technical requirements had the priority, and work on most methodological requirements was start in the second year of the project TIRAMISU.

OPERATIONAL CALIBRATION

- In order to use multisensory system in its full potential, it is necessary to determine its limits.
- Modulation transfer function (MTF) modeling through slanted-edge analysis is used.
- The potential of deriving MTF from slant-edge gives opportunity to use this function not only on target, but also on natural objects.

OTHER REQUIREMENTS

- Other requirements were related to:
  - advancement in the triage and the pre-processing of the acquired multisensor images,
  - projection problems (different input data in different projections),
  - developing of simplified version of the T-AI DSS (without the airborne multisensor acquisition and satellite images, only with MIS data),
  - the trainings of the MAC surveyors (analytical assessment and obtaining of general and specific requirements) and the operators for the airborne multisensor acquisition.

TRIAGE AND GEOTAGING

- The progress has been made in the triage of collecting images and applied on images of destroyed ammunition depot in Padjene.
- The new application that allows automatic geo-tagging images of MS4100 multispectral camera was used.
- Training of two new operators during the airborne acquisition of multispectral images of explosion of ammunition depots was carried out.

CONCLUSION

- Research within TIRAMISU project has the purpose to:
  - filling the gaps that were identified by the end-users, system operators and interpreters,
  - increasing its robustness,
  - decreasing the workload of the operator,
  - improving the semi-automatic mapping of features of interest.

CONCLUSION

- T-AI DSS is a solution that will be proposed to the MACs worldwide for specific terrain and actions.
- A simplified version (without data acquisition) will also be developed that can be used in MACs for the support of the SHA assessment, reduction, re-categorizing and inclusion, only with indicators of mine presence and mine absence derived from MIS data.
- T-AI-DSS will also focus on the problems generated by the possible explosion of ammunition depots.

THANK YOU

ANY QUESTIONS?

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