



TIRAMISU

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

ADVANCED INTELLIGENCE DECISION SUPPORT SYSTEM – BRIDGING THE GAPS

Workshop, Munich, 17-20/09/2012

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- On the basis of the generally defined user needs and requirements from SubWP112, here follow requirements for the needed design which should enable to fill the gaps between the actual functions and the parameters of AI DSS and needed in TIRAMISU AI DSS.

- **REQ-01.** The airborne imagery acquisition in AI DSS requires that the trees in the surveyed areas are without leaves, in order to see the remains of the war, the main sources of new data, information and evidences about the mine suspected area. Develop alternative but feasible methods of the airborne remote sensing, which can decrease negative impact of this limitation.
- **We offer cooperation to partners for this issue.**

- **REQ-02.** The bio-chemical and hyperspectral analysis of the vegetation inside and outside of the minefields could be used for assessment of the minefields (like new type of IMP), of the areas polluted by explosive. Develop the airborne hyper-spectral mine field assessment technology, approved by research and validation.
- **This is our (mostly CTD) research.**

- **REQ-03.** The general airborne hyperspectral survey of the area in and out the exploded ammunition storage should be developed as a new TIRAMISU AI DSS functionality. The ground based collecting of the end-members (spectral samples of referent objects), the airborne hyperspectral, multispectral, longwave infrared and color acquisition of images, fusion of images, processing and interpretation should provide data and information for research and development of this new functionality.
- **This is our (CTDT & FGUNIZ) research.**

- Partners can get some data from Padjane (of military ammunition depot after explosion) after the completion of field work, which is still ongoing (our team collects spectral data with V9 from real minefield), after:
 - *Data specifications (sorting by regions and sensors).*
 - *Our report that we sent to the Croatian State Geodetic Administration from which we asked for and received permission for airborne and ground survey of the area in and out the exploded ammunition storage.*
 - *Obtain permission from the Croatian State Geodetic Administration for data sharing.*

- **REQ-04.** The military helicopter Mi-8, although very comfortable for use, often has limited availability and the flight cost is high. Its endurance is 4:15 h and providing at least 3 h for imagery acquisition, it is possible to acquire high resolution multisensor imagery of 108 km² per day over flat terrain. Another types of helicopters, which are available in the countries afflicted by landmines, shall be analysed regarding the suitability for TIRAMISU AI DSS. The air worthiness certification procedures and costs should be assessed.
- **This is our (CTDT & FGUNIZ) analysis.**

- **REQ-05.** The existing airborne acquisition system weights more than 300 kg, the weight of four persons, operators of the airborne acquisition shall be added. Therefore the airborne equipment should be scientifically advanced, re-designed, with goal to decrease total weight. This shall enable to apply TIRAMISU AI DSS on another helicopters.
- **This is our (CTDT & FGUNIZ) analysis.**

- **REQ-06.** Dependence of the variety of electrical power sources used in the helicopter decreases operational availability of the AI DSS. On board of the helicopter Mi-8 were used following sources of the electric power: a) own batteries 12 V DC, b) 28-30 V DC from the helicopter's spare generator, c) inverters from 28-30 V DC to 220 V AC 50 Hz. Improvement was done in 2010 (filling the batteries during the flight). The continuous and stable electricity supply for the system is mandatory and shall be designed, developed and build up in TIRAMISU AI DSS.
- **This is our (CTDT & FGUNIZ) analysis.**

- **REQ-07.** Operational availability of the acquisition system is limited by the reliability of the applied processing hardware and the software. The acquisition of the images by electro optical sensors, collecting the data of the helicopter attitude by the inertial measuring unit (iMAR), loss of GPS signals often cause the breaks of the acquisition, therefore repeated flights were needed. The research and development shall minimise these problems. The redesign and the development shall solve this problem (set of actions is under way).
- **This is our (FGUNIZ) research.**

- **REQ-08.** The triage and the pre-processing of the acquired multisensor images require the advancement, while they limit throughput of whole processing and interpretation system. Several methods were considered, certain activities are under way (geotagging the sequences of the airborne images, **interactive enhancements of the multisensor images, mosaicing of the sequences**, etc.). The research in the frame of project development and design should support the advancement in this domain, from existing AI DSS into TIRAMISU AI DSS.
- **We offer cooperation to partners for this issues.**

- **REQ-09.** The significant difficulties appear when data from the mine information system (MIS) of mine action centre (MAC), from military maps are applied on the digital ortho photo maps, on the satellite ortho maps, combined with data of GPS and inertial measuring units (iMAR). Although the problem is well known, there are always exceptions that require additional efforts and solutions can not preserve initial accuracy of the hystorical MIS data. This problem is well known in MACs, and the experience in application of AI DSS in Croatia, in Bosnia and Herzegovina enhances the need to develop reliable and feasible solution.
- **This is our (FGUNIZ) research.**

- **REQ-10.** Geocoding of the aerial multisensor images onto a digital ortho photo maps (airborne and satellite) and mosaicking were done manually in AI DSS, this decreases speed and the quality of the data. The procedures for georeferencing, mosaicking shall be defined, developed and applied in TIRAMISU AI DSS.
- **This is our (FGUNIZ) research.**
- **We offer also cooperation to partners for this issue.**

- **REQ-11.** Atmospheric correction of the airborne hyperspectral images is not solved yet. The research and development of the solution suitable TIRAMISU AI DSS is new task.
- **We offer cooperation to partners for this issue.**

- **REQ-12.** Parametric georeferencing of the hyperspectral data into georeferenced images with older version of the software limited capacity and functionalities in application of hyperspectral data. The using of the new version of PARGE 3.1 and 64 bit's processor in computer with larger RAM this limitation can be solved.
- **This is our (CTDT) research.**

- **REQ-13.** Detection and extraction of the «strong» indicators of the mine presence was done manually in AI DSS. The interactive semi-automatic methods of the extraction should be developed for TIRAMISU AI DSS. Certain efforts are under way, one of the promising methods can be the segmentation.
- **This is our (FGUNIZ) research.**

- **REQ-14.** Fusion that is applied in the existing AI DSS is at the rudimentary level and should be advanced for TIRAMISU AI DSS. This is challenge for research in the project.
- **This is our (FGUNIZ) research.**
- **We offer also cooperation to partners for this issue (Nada Milisavljević – RMA).**

- **REQ-15.** The crucial document for the success of AI DSS application is the analytical assessment of the mine suspected area based on data and information that are available in MIS and GIS of MAC. 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 MSA. For TIRAMISU AI DSS should be developed structure and training for MAC survey experts who work on the analytical assessment.
- **This is our (CTDT & FGUNIZ) research.**

- **REQ-16.** Develop simplified version of the TIRAMISU AI DSS (without the airborne multisensor acquisition and satellite images), which can be used in MACs for the support of the MSA assessment, reduction, re-categorisation and inclusion, only with indicators of mine presence and mine absence derived from MIS data and MAC's SOP's.
- **This is our (CTDT & FGUNIZ) research.**

- **REQ-17.** Cooperation of the MAC surveyors in teams for the triage of the aerial images acquired by AI DSS was very useful. Thus the training of the MAC surveyors should be developed for the participation in TIRAMISU AI DSS.
- **This is our (CTDT & FGUNIZ) research.**

- **REQ-18.** Training the operators for the airborne multisensor acquisition should be advanced for the TIRAMISU AI DSS.
- **This is our (CTDT & FGUNIZ) research.**

- **REQ-19.** The calibration of the airborne multisensor images acquisition system is used in AI DSS. The research and the development of the operational calibration methods should increase quality of the data collected from air in TIRAMISU AI DSS.
- **This is our (FGUNIZ) research.**

- **Req-20.** The potentials for dual use of AI DSS have been recognised, and even implemented. The research and development shall support multi-purpose application of the TIRAMISU AI DSS, one example was included in the project.
- **This is our (FGUNIZ) research.**

- **REQ-21.** The implementation of new scientific methods, the development and design based on the requirements from REQ-01 to REQ-21, shall advance TIRAMISU AI DSS in comparison to existing AI DSS following : increase operational availability at least for 100 %, increase the operational capacity more than 50 %, improve parameters of the main functionalities. The all mentioned items shall be defined in the design documents and approved in the testing and evaluation.
- **This is our (CTDT) research.**

SERVICES THAT WILL BE PROVIDED TO USER OUTSIDE OF CROATIA

- 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 which 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. Services will be provided to ensure transfer of know-how and capacity building.
- T-AI-DSS will also focus on the problems generated by the possible explosion of Ammunition Depots.
- Nature of the tools: **Methodology, Training, Guidelines, Services.**

AND IN THE END ...

**We call on all partners to contribute to our research
wherever they think they can!**



THANK YOU

ANY QUESTIONS?

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