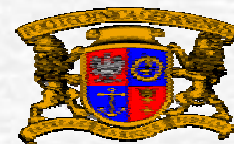




EUDEM2: The EU in humanitarian DEMining - Phase 2.

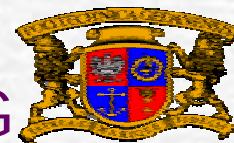
Present and Future of Humanitarian Demining Research

**Concertation Meeting
Brussels, 24/3/2003**



Presentation Overview

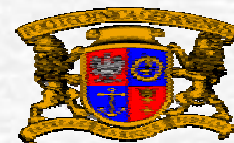
- EUDEM2 Project Overview
- EUDEM2 Main Achievements so far
- Humanitarian Demining: Problem Snapshot
- Progress at Field Level
- General European R&D Situation
- EC Supported R&D Projects
- European R&D Projects' Assessment
- Gaps and Suggestions for Future Directions



EUEDEM2 Overview

- Project Team: VUB (Brussels), EPFL (Lausanne, CH), TUG (Gdansk, PL) + Advisory Panel
- Duration: 2002-2004, Budget: 547 kEuro (EC+CH)
- Mission : **IST SUPPORT** activity:
 - “Support and facilitate the rapid adoption and transfer of experiences and know-how gained in the execution of RTD projects”, **and**
 - “Encourage flexible collaboration between leading researchers both inside and outside the IST programme”.
- Approach:
 - Pro-active information collection, analysis and dissemination
 - *Focussed Information Provider: Focussed Technology Survey.*
 - *Target audience: Technology developers, ongoing projects and the Commission Services*

<http://www.eudem.info/>



EUDEM2 Main Achievements so far

Support:

- *Information Desk* service up and running early on
- *EC Cluster Meetings*: advice and practical support

Dissemination and Exploitation:

- Large information collection and analysis effort →
Fully revised and expanded EUDEM Website
- Very good response level

Workshops:

- Preparation of EUDEM2-SCOT conference, Brussels 14-18 Sept. 2003.

<http://www.eudem.vub.ac.be/eudem2-scot/>

Technology Survey:

- Emphasis on *sensor developments*, initially on each partners' field of interest

HD Problem Snapshot

Current Tools:

- Metal (not mine) Detectors. Installed base (in HD): 10-20,000 @2-4 kEuro.
- Demining dogs. Installed base: 500-1000
- Mechanical tools, in particular vegetation cutters. Installed base: a few 100
Cost: 200 kEuro upwards.

Relatively young industry: e.g. start Afghanistan late '80s.

Demining cost: ~1 Euro/m² (order of magnitude, actual clearance)

Problem specificities:

- Mostly developing countries (Afghanistan, Angola, Cambodia, Mozambique, ...)
- Wide variety of scenarios and requirements. Researchers/end user *GAP*.
- Severe requirements (cost/performance/ergonomic aspects)
- Dogs'/metal detectors' performance only starting to be scientifically addressed (lack of basic studies)



Progress at Field Level

Real progress at field level! Situation less severe than initially assumed

Gaps getting closed

- Mechanical systems/vegetation cutters (at application level)
- Standardisation activities
 - IMAS (GICHD), metal detectors (ITEP/CEN)
 - Equipment Catalogues (mechanical, MD)
 - Critical testing of existing equipment (MD: IPPTC)
- Information Management (IMSMA)

Open gaps being addressed

- Mine dogs/artificial noses: basic knowledge of explosive diffusion & transport (GICHD: Sandia, FOI)
- Mechanical systems (basic understanding)
- Test and evaluation results (ITEP)!
- **User Needs and Operational Scenarios!**

Most of practical improvements up to now have come from field users

European R&D Projects' Assessment (1/2)

Some Results so far

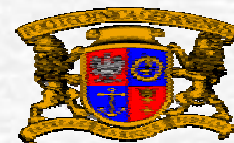
- Advances in basic knowledge (low visibility unfortunately!)
- Novel sensing applications, e.g. digital discriminating metal detector
MINESEYE: DIPS, DEMINE GPR array, ...
- Clear focus on end user requirements in the design and integration of a multi-sensor system
HOPE: MD+GPR+MWR, LOTUS: MD+GPR, DIAMINE: MD+NBS, ...
- Airborne wide area survey
- Equipment Testing in "realistic" field conditions, with end user support
- Trace explosive detection (BIOSENS only)
- Testing facilities: now available at JRC, TNO, FOI, Croatia, Bosnia, Angola/Namibia, ...

General European R&D Situation

European *fragmented* research scenario, featuring:

- ☛ Purely defence oriented projects
 - E.g: Airborne AT minefield detection
- ☛ Humanitarian Demining oriented project
 - “Open” R&D projects:
 - EC financed (international)
 - Some national (ex. NL, INFN/Explodet, Italy, Belgium)
 - National projects mostly financed from defence sources: UK, NL, S, D, ...
 - National projects financed by both MoD & development aid agencies (HUDEM, few, ex. MINETECT, ERA Ltd. UK)
 - National projects financed from general research funds (mostly academia)

EUDEM2 aims at keeping track of some of these developments



EC Supported R&D Projects

EC Projects Overview

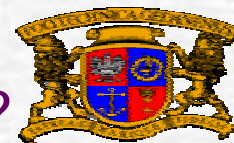
- Feasibility Study (1995)
- DG-ECHO Airborne Pilot Project
- FP4 ESPRIT HPCN Projects
- FP4 Support measures (Mimeva, EUDEM, ...)
- FP5 IST , GROWTH
- JRC

General Focus

- Mostly *sensors*, and in particular multi-sensor systems, for close-in detection
- Sensor fusion
- Wide area survey as from FP5
- Clearly humanitarian demining oriented

Individual Project Focus

- Hand-held multi-sensor landmine detection systems, ex. MD+GPR
- Vehicle based multi-sensor systems, ex. MD+GPR+IR
- Airborne wide area survey
- Trace explosive detection (BIOSENS)



European R&D Projects' Assessment (2/2)

Why instead the impression that little has been achieved?

- One clear result still missing
- Too high initial expectations and problem "ignorance"
- Lack of long term commitment (financial, project's continuity) through all development phases
- Lack of R&D coordination (but how much is practically achievable?)
- "Unfair competition" from tools established through practice, yet imperfectly assessed (MD, dogs)
- Industrial/end user partnership essential ("risk management" on both sides)

Overall Considerations

- + Few systems seem mature for more extensive testing
- + Better problem/constraints understanding
- - Integration effort often underestimated
- - Testing and evaluation effort usually underestimated and often carried out too late ("waterfall" model).
- - How to effectively feed a project's results into the following ones?



Gaps and Suggestions for Future Directions

☛ Gaps at EC level

- Sharing of results/experiences
- Build success stories
- Focused calls

☛ Management Issues

- Add intermediate system testing.
- Do not leave data fusion “at the end”
- Harmonize level of experience within project – avoid starting from scratch...

☛ Sensors and their Integration

- Move towards final stages of developing sensors
- Focus more on the **integration** of what was done so far

☛ Testing

- Emphasize test and evaluation. However: the required resources are extensive!
- Take prototypes to the field

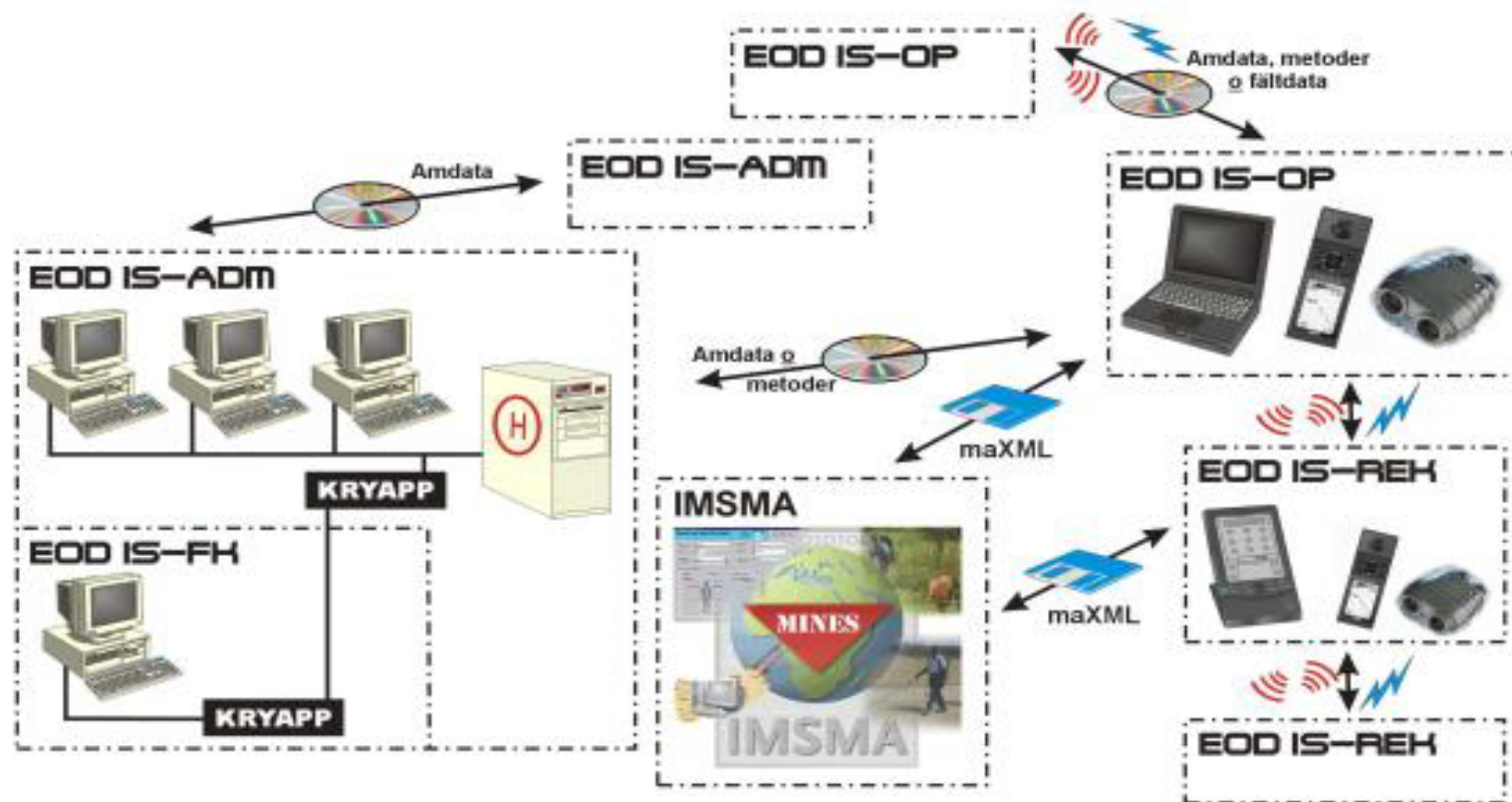
Suggestions for Future Directions

Information Technology

- Put emphasis on practical applications of Information Technology – hide system complexity! Examples:
 - (Minefield) Survey, Mapping, planning, management,, ...
- Integration and use of well known (commercial) technologies
 - GIS, Satellite images, Off-the-shelf GPS, palm tops,...
 - E.g SWEDEC's EOD-IS, Paradis, ARC, ...
- Leave door open for really appealing research topics, e.g. OO (Relational) Spatial Databases.



SYSTEM & INFORMATION



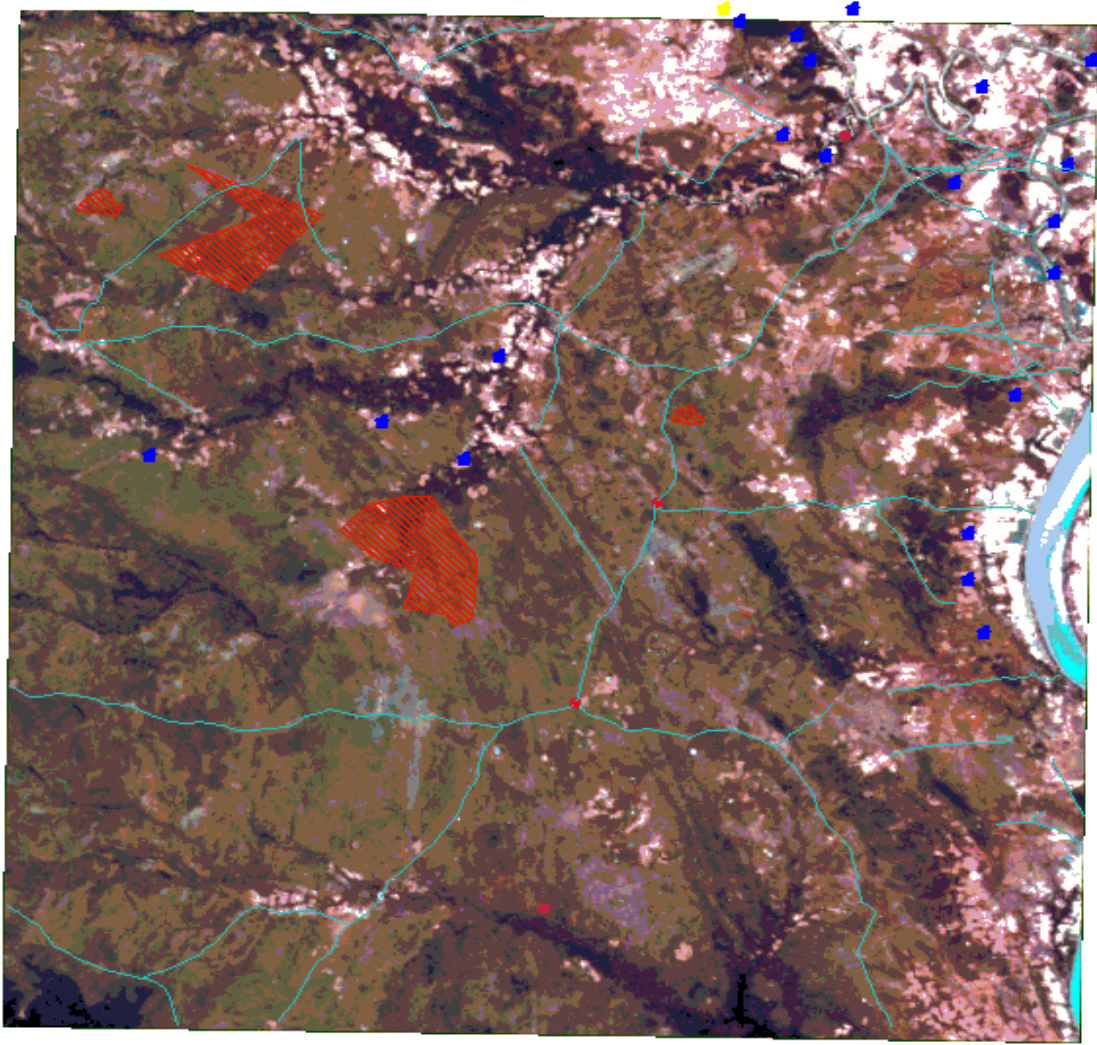
File Edit View Theme Image Analysis Graphics Window Align Export Help



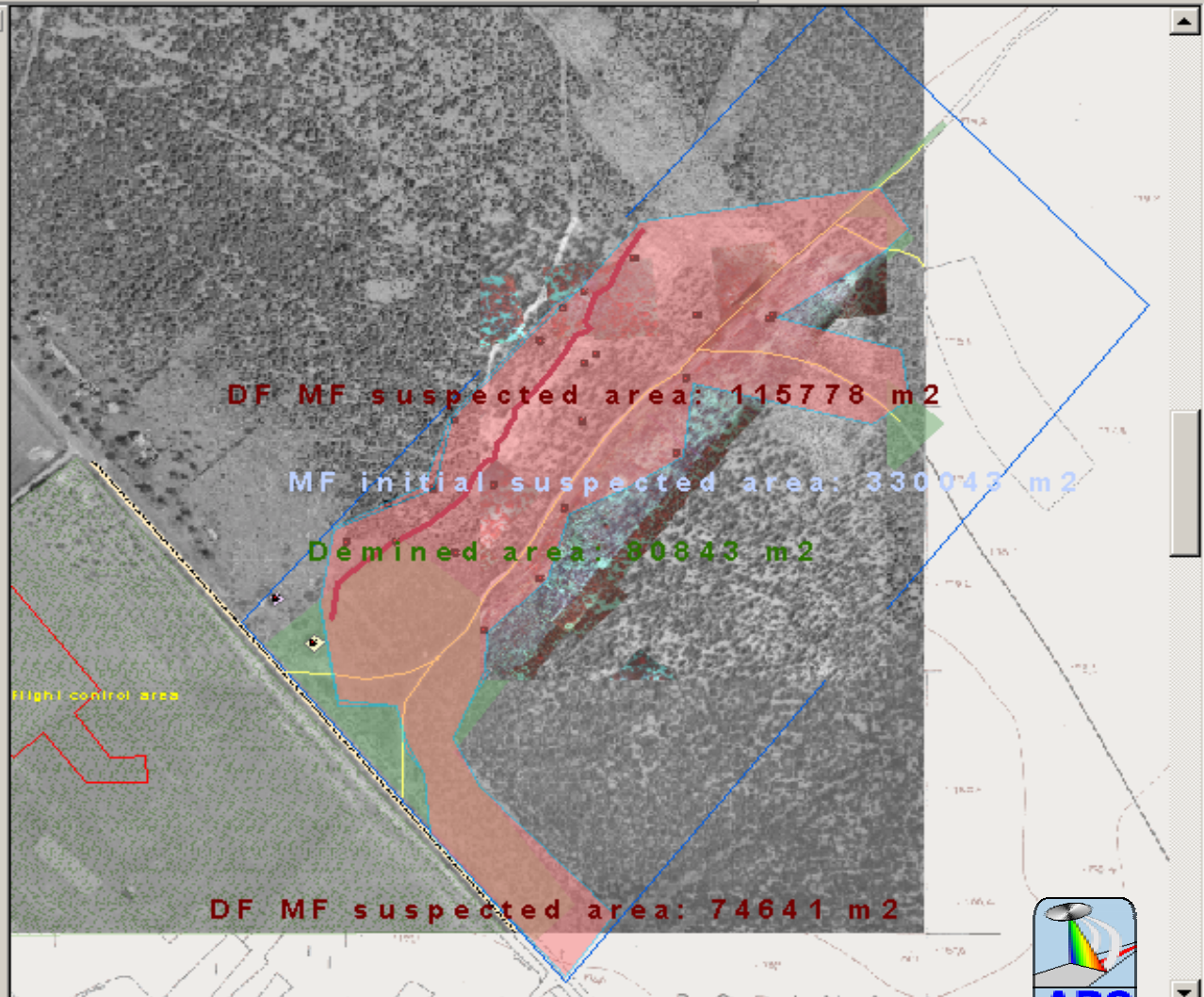
Scale 1: 154,624 595,310.831 1,605,718.579

Region Scale Map

- track
- Examplegps coord
- Towns
- Minefields
- ban_nakok_merge
Res: 1:2,6
:Layer_4
:Layer_2
:Layer_1



- Flight7
- Flight8
- Flight9
- DataFusionFeatureLayers
 - DFMinefieldSuspectedArea
 - Minefield Indicators
- ImageProcessingFeatureLayers
 - ManMadeObjects
- ImageInterpretationFeatureLayers
 - DryWall
 - Demolished house
 - House
 - Bunker
 - UnusedRoad
 - DemolishedCar
 - Cultivated area
- OptronicSensorImages
- Minefield records Layers
- Minefield Assessment layers
- ReferenceGIS Layers
- ReferenceOrthophotos



Suggestions for Future Directions

Other Technologies

- (Re)Consider dual/multiple use technologies to tackle the problem of the small and shrinking market.
 - Range remediation / EOD tasks (not only mines!!)
 - Other security applications (airport, ...)
- Include incremental improvements and adaptations of existing technology. Criterion: *added value* to the field user! Examples:
 - Dummy mines
 - Training aids
 - Quality Assurance



Suggestions for Future Directions

Two tracks:

- Partnership with End Users
 - Speed-up the integration of new developments into demining operations
- Basic Research
 - Enhance Technologies
 - Study limitations of existing and new developments
 - Lateral thinking: let ideas flow freely

Long term vision carry through

Diffusion of R&D results and End User needs

Keep: focus on humanitarian demining and end user input (specificity of EC sponsored projects!)

Improve: coordination with international HD bodies, in particular GICHD!