

Borut Jagarinec  
Natasa Ursic  
Robert J.Peckham

# Harmonised GIS for Mine Action in S.E. Europe

The paper describes recent initiatives which are contributing to the establishment of a harmonised GIS for mine action in South East Europe. While these initiatives have been oriented particularly towards the needs of the mine action community, they are also clearly relevant for the needs of other communities with humanitarian, environmental and security concerns in the region.

The problem of mine contamination in S.E. Europe continues to be very serious, causing casualties and creating obstacles to socio-economic development. It will continue to be present in some of the countries for a time-scale of the order of ten years - if present rates of mine clearance can be sustained, and this is not certain. Planning and monitoring of mine actions requires the use of GIS, and these will be more effective at handling regional and cross-border aspects if systems and data are harmonised at the regional level. There is therefore a need to establish a regional geographical information infrastructure among the organisations in the mine action community. The first EU supported initiative with this aim was the setting up of the Working Group "Towards Harmonised Information Systems for Mine Action in S.E. Europe". The group was composed mainly of participants from the Mine Action Centres (MACs) of Bosnia Herzegovina, Croatia and Kosovo and was coordinated by the Joint Research Centre. It worked initially on establishing the contents and formats of very basic georeferenced datasets describing the extent of mine contamination and related accidents in these countries, to be exchanged among the participants and with the EU.

In these and other meetings with experts from MACs in S.E. Europe the urgent need for reliable maps for all mine-affected countries was repeatedly raised. A project was subsequently started to strengthen the GIS and mapping resources available in the region, and to work towards harmonised methods and data for this community. A project was jointly funded by the EU and the US Department of State and was implemented through the International Trust Fund for Demining and Mine Victims Assistance. It included a multi-resolution approach to the development of imagery and vector data for the region and aimed to bring the different organisations up to a similar technical level through training, jointly coordinated projects and shared experience in the working group. The first step in the multi-resolution approach was the development of low resolution coverages for the whole region using Landsat imagery for 1990 and 2000, land-use classification and change detection. In the next step medium resolution data was obtained for specific countries using IRS imagery. Another initiative to define an XML schema to facilitate information exchanges in mine action has also been started by the US Dept of State, and this is being developed in collaboration with the UN and with the EU's harmonisation approach.

The paper reports on the progress and achievements made so far and the lessons learned which are relevant for the establishment of geographical information infrastructures in these countries.

---

## 1. Introduction

Mine contamination in S.E. Europe continues to be a very serious problem, causing casualties and creating obstacles to the socio-economic development of the region. It will continue to be present in some of the countries for a time-scale of the order of ten years, assuming that present rates of area reduction and mine clearance can be sustained, and this is not certain as it depends on donor funding which is not guaranteed over this time-scale. All contaminated countries in the SE Europe have established an effective mine action system with a goal of freeing their territories from landmines. However, even with their programmes the present clearance rate for at least two countries Croatia and Bosnia and Herzegovina is too low to achieve the objectives of its programmes and obligations undertaken by signing and ratifying the Ottawa Convention.

No serious part of humanitarian demining could be done without a developed information system. Since humanitarian demining activities are related to an open space, a large part of Mine Information System (MIS) relates to GIS. The planning, implementation, and monitoring of mine actions requires the use of geographical information systems, and these will be more effective at handling regional and cross-border aspects if systems and data are harmonised at the regional level. There is therefore a need to establish a regional geographical information infrastructure among the organisations in the mine action community. Such an infrastructure should facilitate access to maps and other georeferenced information, and sharing of information leading to improved planning and efficiency of operations.

In March 2000 a workshop was held at the European Commission's Joint Research Centre, entitled "Towards Harmonised Information Systems for Mine action in S.E. Europe". It brought together representatives of the main organisations supporting mine action, and operating in S.E. Europe to present and discuss ideas and proposals for improving the interoperability of their information systems. The proceedings and conclusions of the workshop are reported in (1). One important conclusion was that there was a need to facilitate the exchange and sharing of geospatial information related to the region. While this was also needed for mine action at global level, the implementation of a clearing house specifically dedicated to geospatial information for S.E. Europe would help to accelerate progress in this region, and it would be necessary in order to support the implementation of the Stability Pact (2). The best way forward would lie in building partnerships which would include the afflicted countries. The mode of working should be based on providing support to afflicted countries and should encourage the establishment of the appropriate databases within the afflicted countries. The clearing house should provide a single point of contact to respond to the needs of teams and organisations working in the region. It should be responsive, with a "customer service" attitude to meet real needs. As the EC was then preparing a coherent approach for humanitarian demining in the context of the Stability Pact, such a clearing house was considered to be one element of the approach.

The workshop also found that there was a need for more detailed technical meetings of representatives of the afflicted countries to identify information requirements and coordinate exchanges. It should compare their existing databases, identify their needs, and work towards standards and agreements for those specific countries. This should ensure the involvement of these afflicted countries in defining the way ahead, and focus on a set of practical measures which will assist the planners at field and headquarters levels with the provision of accurate, appropriate and timely information. A bottom-up approach was recommended as it should work better than hard imposition of standards from above.

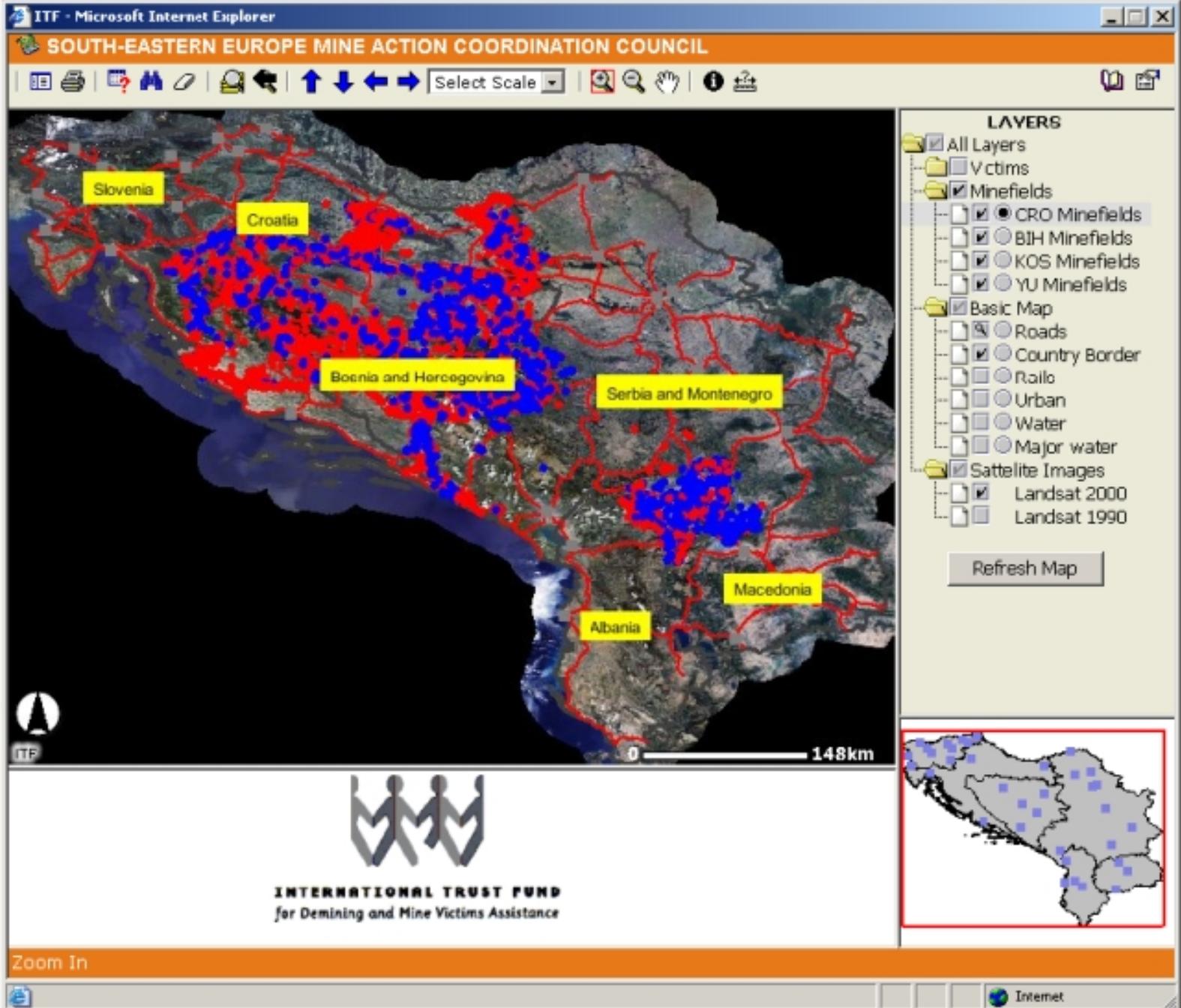
## **2. The Working Group**

Following this workshop a Working Group was set up to coordinate and implement information exchanges

between the MACs in the region and the European Commission, as well as among the MACs themselves. The conclusions of its first meeting, which was held in Sarajevo in September 2000 are reported in (3). They include the contents and formats of information which was agreed to be exchanged at 6 monthly intervals among the participants. The content was deliberately kept to a very simple set of information items which could realistically be expected to be exchanged. It describes mined areas (including geographic coordinates, and ordnance types) and mine victims (including geographic coordinates, numbers of victims, and types of activity leading to the incidents).

This information has been exchanged at six monthly intervals for Bosnia- Herzegovina, Croatia and Kosovo, and has permitted an overview of the situation in these countries to be maintained, see fig 1 below. As other countries in the region established MACs and improved their information system resources they also participated in these exchanges.

<



At the start of this work it was apparent that two of the countries, Bosnia- Herzegovina and Croatia had already set up substantial information systems, including GIS, in support of their Mine action Centres. Furthermore these systems were deeply integrated into the ongoing working processes for mine clearance and area reduction, making these MACs reluctant to accept imposition of any externally designed standards which would necessitate interruptions and changes to their ongoing working procedures. In Kosovo, where mine clearance had started later, the UN standard Information Management System for Mine action (IMSMA (4)) had been adopted, and was being effectively used. It was therefore found that the best approach to achieving harmonization across the region would be to aim for a gradual evolution as systems were updated. This would involve the working group, sharing experiences and information, and gradually adapting the existing systems towards agreed standards, while respecting legal and procedural differences across the countries which would inevitably remain. This approach therefore required emphasis on interoperability of systems and data, rather than aiming for identical systems.

### **3. The Project "GIS for Mine Action in S.E. Europe"**

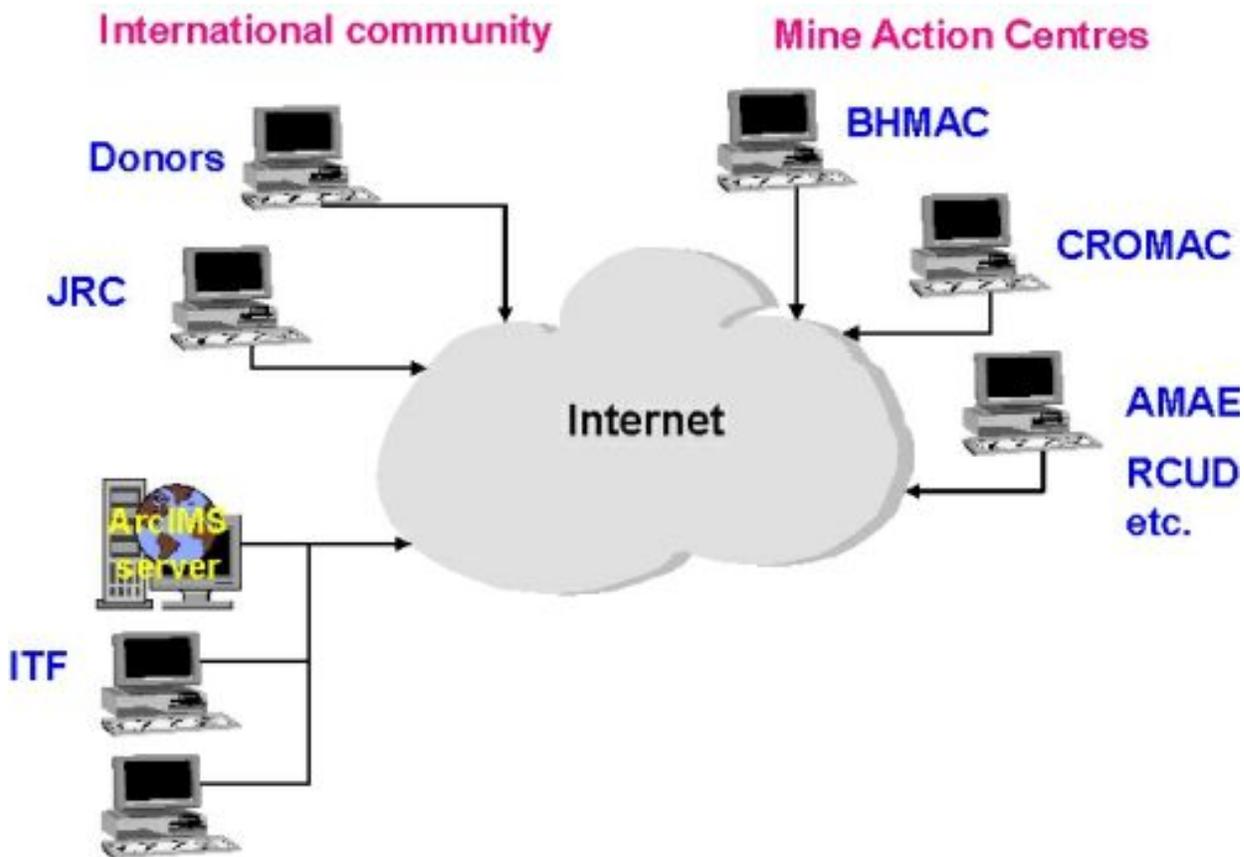
In the meetings described above, and other meetings with experts from MACs in S.E. Europe, the urgent need for reliable maps for all mine-affected countries was repeatedly raised. A project was subsequently initiated to strengthen the GIS and mapping resources available in the region, and to work towards harmonised methods and data for this community. Project was jointly founded by the European Commission and the US Department of State.

The intention was to build on individual needs of each nation to bring them up to the same level in terms of facilities, skills and data. Another intention was to identify commonalities and synergies, and to co-ordinate the EC efforts with those of other donors, especially the US Department of State, in order to upgrade the efficiency of the whole information system.

The project was implemented through the International Trust Fund for Demining and Mine Victims Assistance (ITF) and under scientific guidance and monitoring of the EC Joint Research Centre (JRC). The project made significant contribution to the construction of a geographic information infrastructure for this community as it included development of a distributed information system, based on internet, and a multi-resolution approach to the development of georeferenced imagery and vector data for the region.

#### **3.1. Distributed information system**

Through the Working Group an analysis of the needs of the Mine action Centres for hardware and software for GIS and image processing was made. This led to development of suitable equipment Guidelines for the region, and this has been followed by equipping the MACs (or strengthening existing resources) through calls for tender and purchases. The same guidelines were used for new MACs as they came on stream (e.g. in Serbia and Montenegro), and they will be updated according to needs.



No GIS can exist without trained personnel. So, next step was supporting the staffing of the MACs with personnel to apply the GIS and image processing techniques in their working processes. Specifically staffing has been supported in Albania, Bosnia Herzegovina, Croatia, Serbia & Montenegro and at the ITF. Two regional training courses adopted for MACs needs were implemented. These specific training programs were designed to improve the capabilities of MACs in relation to GIS, GPS, geodesy, aerial ortho-photography, remote sensing, and in particular in the use of maps and imagery for the provision of useful data to be incorporated in their planning, implementation and monitoring of mine action programs.

A web site has also been set up at [www.see-demining.org](http://www.see-demining.org) and from here it will be possible to download geographical information data sets developed in the project. This is therefore the first step in creating a clearing house for this particular community for the region of S.E. Europe. It should eventually be linked to the global clearing house set up by James Madison University (6).

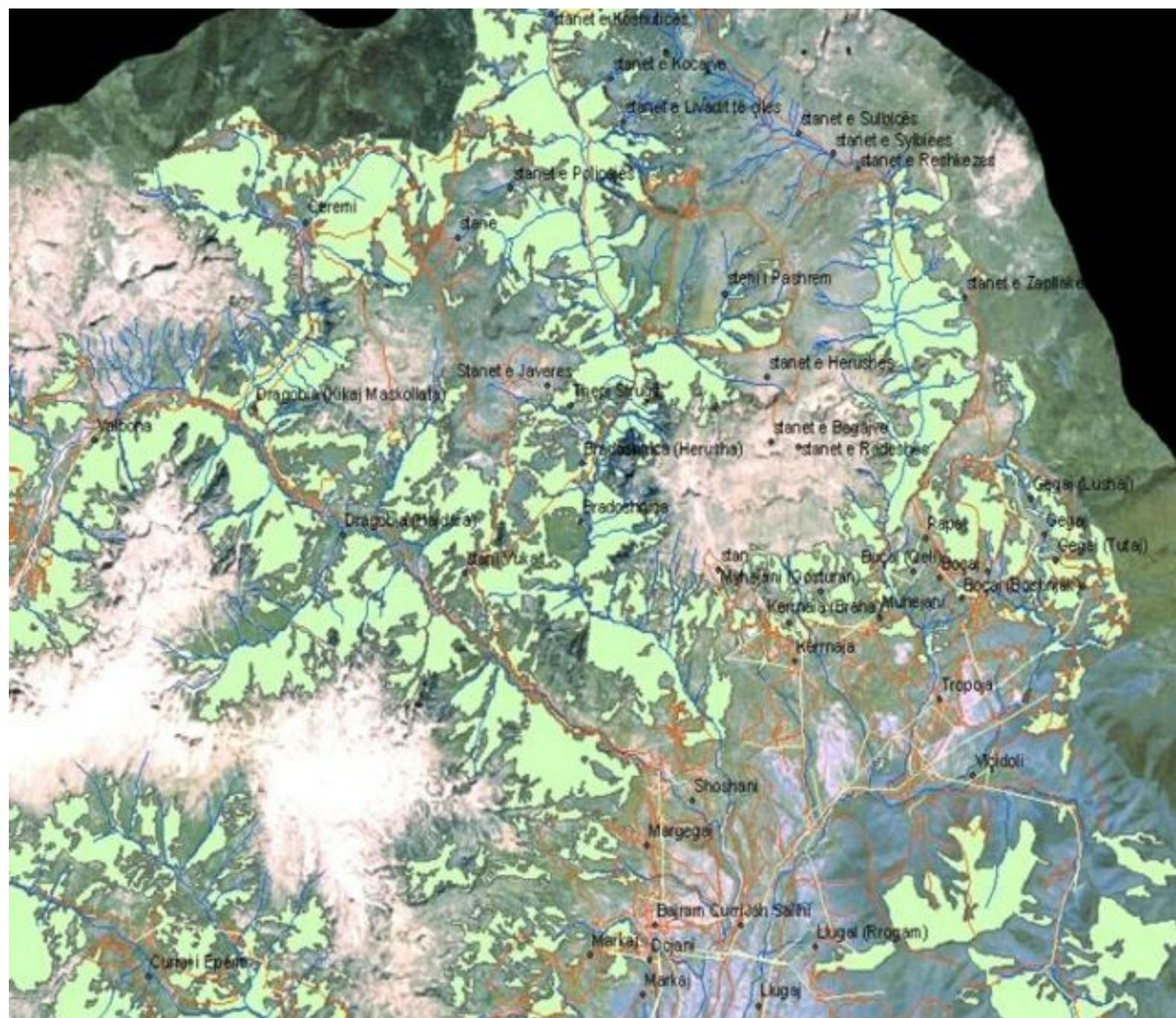
### 3.2. Imagery and Map development

Through the work of the Working Group it was identified that a multi- resolution approach to mapping was needed in order to satisfy the diverse range of requirements for mine action which cover different spatial scales. The requirements ranged from regional planning (requiring approx. 1:100,000 scale maps), through local planning and monitoring (requiring approx. 1:25,000 scale maps), to detailed mapping and monitoring of mine clearance operations in specific areas (requiring imagery at 1:5,000 scale or better). It was also found that the European Union Satellite Centre (EUSC) had already developed significant digital map coverages, based on satellite imagery for Kosovo, Montenegro and Macedonia. It was decided that, rather than duplicate the work of the EUSC, the project should continue to "fill in" with data for remaining countries at medium resolution. At the

same time permission was sought and already granted to make use of the EUSC information for humanitarian mine action purposes. Albania was identified as the next country to be covered by medium resolution data, as its mine action centre had virtually no digital data resources.

The multi-resolution approach currently being implemented therefore includes:

- Low resolution coverage of the whole region with Orthorectified Landsat7 imagery, land cover classification, change detection for 1990 - 2000 and inactive land analysis developed by EarthSat Inc. (5) and basic vector layers - ESRI ArcEurope Base Map and ArcEurope Demographic;
- Medium resolution, IRS PAN/LISS imagery coverages and GIS vector maps for Albania, Macedonia, Montenegro and Kosovo (Serbia and Montenegro)



- High resolution aerial orthophotos for priority areas defined by BHMAL and CROMAL
- A comparison between aerial photogrammetry and satellite imagery for high resolution work on a test area in Croatia implemented by GisData;

One of the important tasks of the project was a supply of information on landmine contamination and mine actions. Instead of delivering situation on hard copies or with other conventional means, ITF decided in the coordination with the Working Group to present information on-line through the Web. In this way information is constantly available not only to the European Commission but also to the demining community and public. GIS web server at [www.see-demining.org](http://www.see-demining.org) was developed on ESRI ArcIMS platform (current version 4.01). It is organised in two levels. First is public and it is opened for public use. Second one is secure and can be accessed only with appropriate password. Second level offers more tools and possibilities for the GIS analyses. Primarily is intended for GIS specialists inside MACs.

## 4. The maXML Initiative

One of the on-going projects in support of Information Technology in mine action at the Geneva International Centre for Humanitarian Demining (7) is the development of an extensible Mark-up Language (XML) specification for information related to mine action activities. The intention of this XML specification is to provide a simple means of sharing mine action data within the community as well as with other related communities. FGM Inc. (8) is working closely with the Geneva Centre to define and coordinate the development, maintenance and distribution of this XML specification. XML technology should make it easier to transfer data between existing and future mine action information systems. The end product of the mine action XML (maXML) project will be an XML information specification made freely available to the mine action and other communities for use in exchanging information. The developers have been holding meetings with organisations concerned with mine action to ensure that the needs of all potential consumers of mine action Information are taken into account. They are also taking account of, and building on, other relevant standards where they exist; for example GML for geographic information and other XML type standards from the fields of Medicine, Electronic Business and International Development. The challenge which is currently being addressed by FGM is to try to ensure that the specification is complete for all potential users and self consistent.

In the region there already exist three different MIS and GIS, one is in use in Croatia (CROMAL), one is used by BHMAL and of course IMSMA (Albania, Macedonia and Kosovo). Very soon MACs in Serbia and Montenegro will start to use IMSMA. The Region is very heterogeneous regarding information systems, but there exists a network of countries which have already initiated useful information exchanges. Within this context S.E. Europe was chosen for pilot implementation of maXML.

## 5. Lessons learned

The circumstances of this particular group of mine afflicted countries in S.E. Europe, which have been involved in damaging conflicts within the last decade, have meant that setting up a geographic information infrastructure requires a particular effort in initiating and maintaining collaboration. A key element of the approach described here is therefore the Working Group (Technical Advisory Group) through which information is exchanged, the joint approach is defined and actions are coordinated.

It has also been found that, due to the existence of legacy systems which are deeply integrated into ongoing working procedures and adapted to support legal and organisational requirements in individual countries, rigid imposition of standards is not the best way forward. It has been found more practical to work towards interoperability of systems as they are updated and improved, and to encourage and facilitate information exchanges in a step by step approach. At the same time regional guidelines are being drafted and updated as required, and these will be applied for new MACs as they come on stream.

Strengthening the GIS competencies in the region through joint training has also been found to be very productive. The fact that the part of the training was given by one of the MACs using its own equipment has shown that the countries can collaborate and assist each other in moving forward.

## 6. Conclusions

Some recent initiatives which are contributing to the establishment of a harmonised GIS for mine action in S.E. Europe have been described. The main elements of this regional approach being followed are:

- the Working Group, composed of professionals working with MIS and GIS in the MACs, and acting as Technical Advisory Group for the jointly funded project;
- the concept of a distributed information system, based on internet;
- the guidelines for GIS and MIS for use in the region;
- the multi-resolution approach to development of georeferenced imagery and mapping for the region;
- web pages at <http://www.see-demining.org> which are becoming the hub for information exchanges in the community and the initiation of a clearing house for the geographical information for use in mine action in the region.

The maXML initiative of the Geneva International Centre for Humanitarian Demining also has the potential to further facilitate information exchanges and become an important element in the regional GIS.

While these initiatives have been oriented particularly towards the needs of the mine action community, they are also clearly relevant for the needs of other communities with humanitarian, environmental and security concerns in the region.

## Acknowledgements

The project "GIS for Mine Action in South Eastern Europe " was jointly funded by the European Commission and the US Department of State. Donors and members of the Working Group are thanked for their contributions to the project and the information exchanges.

## Acronyms

- AMAE – Albanian Mine action Executive

- BHMACH - Bosnia and Herzegovina Mine action Centre
- CROMACH - Croatia Mine action Centre
- EUSC – European Union Satellite Centre
- IMSMA - Information Management System for Mine Action
- ITF - International Trust Fund for Demining and Mine Victims Assistance
- JRC – European Commission Joint Research Centre
- MAC - Mine Action Centre
- XML - eXtensible Markup Language
- maXML - Mine action eXtensible Markup Language

## References

1. Peckham, R.J. (editor) Proceedings of the workshop "Towards Harmonised Information Systems for Mine action in South Eastern Europe", European Commission, EUR 19564 EN, 2000.
2. Stability Pact: <http://www.stabilitypact.org/>
3. Workshop conclusions: <http://eu-mine-actions.jrc.cec.eu.int/events/wks0003/conclusions.htm>
4. IMSMA: <http://www.imsma.ethz.ch/>
5. Imagery and Land Cover: Base Layers for a Regional Planning GIS. International Trust Fund for Demining, Ig, Slovenia; Earth Satellite Corporation, 6011 Executive Blvd., Suite 400, Rockville, MD 20852, USA, March 2002.
6. James Madison University <http://maic.jmu.edu/index.htm>
7. Geneva International Centre: <http://www.gichd.ch/>
8. FGM Inc.: <http://www.fgm.com/>
9. GISDATA: <http://www.gisdata.si/>
10. Towards a GI Infrastructure for Mine Action in S.E. Europe, R.J. Peckham, B. Jagarinec, EC-GI&GIS Workshop, June 2002

---

Borut Jagarinec  
 Head of Informatics Department  
 International Trust Fund for Demining and Mine Victims Assistance