PROBLEMS AND EXPERIENCES IN UPDATING THE CONTENTS OF THE OLD MILITARY TOPOGRAPHIC MAPS AT LARGE SCALES

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ABSTRACT

The paper presents the experiences in updating the contents of old topographic maps at the scale of 1 : 25 000 and 1:50 000, the problems occurring in that respect and the introduction of computer support (hardware and software) in the process of map production.

The procedure of updating the contents on old military maps at the scale of 1:25 000 and 1:50 000 is based on observing, introducing and accepting new standards and technologies as well as searching one's own specific solutions not known so far and applicable in cartographic activity.

1. INTRODUCTION

The fact that the reproduction materials for military topographic maps and general topographic maps left in the former state are not available, and have obsolete contents, also differing in the cartographic and geodetic sense from the maps of neighbouring countries, and above all that, there is a need to produce digital bases for C^3I/C^4I (Command Control Communication and Intelligence/Command Control Communication Computers and Intelligence), demands the initiation of the systematic production of new military maps, above all, at large scales.

In the C^3I/C^4I system the optimum quantity of information about space, i.e. the produced military geographic information system, has an essential significance in monitoring and analysing the execution of the combat activities by using the most recent information technologies. Such a system must be characterised by efficiency, flexibility and resistance.

The most of these problems burden also the civil cartographic activity in the Republic of Croatia (Gojceta, 1998; Paj 1998), as well as the cartographic activity of the other

states established after the disintegration of the former state (Petrovic 1998; Radovan, Petrovic 1998).

2. NECESSITY OF PRODUCING NEW MILITARY MAPS

The procedure of facsimile publishing of military maps at various scales that was used at the beginning of developing the cartographic activity (Horvat et al, 1997) has been recently supplemented with digital methods of map processing. Since this procedure is much more oriented towards the map reproduction, and much less towards the establishing of databases, it does not meet the defence needs in the field of establishing military geographic information system.

The cartographic activity in the Republic of Croatia has inherited, referring to the scale systems of topographic and general topographic maps, and continues to maintain the system of the following map scales 1:25 000, 1:50 000, 1:100 000, 1:200 000, 1:300 000 and 1:500 000.

This scale system is incompatible with the scale system used by the neighbouring western countries and with their military cartographic policy.

In the forthcoming period, the production of the maps at the scale 1:50 000 and 1:250 000 will be given priority by the Croatian military cartographic service.

The military map at the scale of 1:25 000, a detailed tactical map of the armed forces of the Republic of Croatia will be made only for the areas of special significance for the defence, as for example of larger cities and military locations.

3. PROCEDURES OF MAP PRODUCTION AT THE SCALE 1:25000 AND 1:50 000

About 900 sheets of military topographic maps at the scale of 1:25000 (MTM25) and 1:50 000 (MTM50) should be made for the territory of Croatia. For the completion of the entire project, a longer period will be needed considering also to a certain extent limited financial situation. The contents of the maps for larger cities, the areas with drastically altered situation caused by war activities and ruining, and the areas of a special interest are being updated in the first phase.

Old military topographic maps were made in the conform Gauss- Krüger projection, according to the Bessel 1841 data, the sheet format is 7’30” x 7’30” for MTM25 and 15’ x 15’ for MTM50.

The new military topographic maps are being made in the UTM projection, according to the WGS 84 data, the presentation format is 5' x 3' for MTM25 and 20' x 12' for MTM50, with bilingual information in the marginal contents.

3.1. Origins

In the production of updated sheets of the topographic map at the scale of 1:25 000 and 1:50 000 there are various origins in analogous and digital form used, as e.g.:

- printed military maps at the scale of 1:25 000 and 1:50 000 published by the former VGI (Military Geographic Institute), the contents originating from 1985-1989,
- aerial photogrammetry survey data,
- satellite SPOT and LANDSAT images,
- a database of trigonometric points,
- a map with the presented hydrography and contour lines (so called OH map).

3.2. Scanning of topographic maps, separating the contents into origins according to the printed colours and geocoding

The first step in the procedure of updating of MTM25 and MTM50 is scanning the printed map sheets. The printed map sheets present more than 10 years old contents. The maps are not usually kept in the same conditions, what results with different drying quality and colours.

The scanning is carried out in the resolution of 1028 dpi (for this purpose the scanning resolution of 514 dpi would be sufficient) (Malic 1998).

For the purpose of further supplementing (revising) the contents, the scanned maps are separated electronically into the colours of original map printing, i.e. into the following publishing origins:

- **origin for a blue colour**: wells, rivers, streams, channels, swamps, various hydrographic objects, water falls, river flow direction, all hydrography titles, water surfaces (point raster) and their shores and the number of the neighbouring zone co-ordinate network;

- **origin for green colour:** areas covered with forests, shrubbery and macchia, parks (line raster) and orchards (point raster), all vegetation boundaries (except

parks), symbols for trees (except for noticeable and far visible trees), shrubbery, green fences, narrow forest belts and young seedlings;

- **origin for brown colour**: contour lines, hachures, slopes, swallows, rocky cuts, gorges, stone ground, lonely rocks and numbers indicating contour heights;

- **origin for orange colour**: inner road surfaces presented with two lines, streets with public roads running through them, inner circles of church objects, antenna pillars and the inner space of the symbols for a monument or a skyscrapers;

- **origin for black colour**: situation, cartographic network and titles.

3.3 Processing of scanned maps

Geocoding of raster reproduction origins has been made according to the co-ordinates of the sheet corners by applying the projective transformation. The map neat-lines and cartographic network have been computed in the conform Gauss-Krüger projection, and according to the Bessel 1841 data.

By overlapping of computed and delineated network and the geocoded scanned originals, there have been the deviations of less than 0,1 mm noticed.

After the network, the trigonometric points have been mapped from the “Catalogue of Trigonometric Points”. The deviations between the newly mapped trigonometric points and those on the scanned raster original run up to 0,1 mm in hilly areas (2,5 m on the ground), and in the plane areas, as well as in cases where trigonometric points are churches, the differences are the minimum (can be neglected).

Using the cartographic key in a digital form, the database of cartographic symbols for MTM25 and MTM50 has been made. All symbols for point objects have been automatically brought on the originals during the proces of vectorisation.

The usage of GEOVAC software in combination with the modules of MICROSTATION has enabled the semi-automatic vectorisation of all line elements. The axis has been defined for roads and they have been categorised at the same time according to the valid official categorisation of roads.

3.4. Revision of contents

The map sheet is divided into several units.

In order to determine the differences in contents and to make the revision, the digital orthophoto at the scale of 1:25 000 has been made first on the basis of aerial photogrammetric survey. By connecting raster contents (scanned reproduction origins and the digital ortophoto) we obtain an arranged background for the performance of the revision by manual vectorisation. After determining the difference in the contents, they can start to be generalised and revised. Such digital vector form is attached with titles as well as marginal contents, and the map is prepared for the production of reproduction originals (by means of exposing it on the film) and then for printing.

For the purpose of revision of the forest areas, we use satellite images SPOT XS and LANDSAT TM as originals. This method of spatial survey, forest mapping, making an inventory, as well as of monitoring the changes on the basis of satellite images offers satisfactory results (Kusan 1996).

The elements that cannot be decoded on orthophoto or satellite images are marked, decoded and revised classically in the field. Special military data as e.g.: the data about the ground composition and road width, road type, the data about the quality, width, length of bridges, the data about the type, density and widths of forest trees, and the river and channel width, are also gathered by means of field survey.

A special attention is given to the production of the title originals. For each type of titles (toponyms, hydronnyms, oronyms), the title layers are made. Although the map was made in the VGI (Military Geographic Institute) of the former state, it can be noticed that there are no larger discrepancies between the titles given on maps and the real ones.

4. CONCLUSION

In the process of solving the problem of updating the contents on old military maps at large scales, and due to the absence of reproduction originals, we have developed our own methodology. In this way it is possible to produce maps with updated contents of higher quality, relatively quickly and with smaller investments.

REFERENCES:

Gojceta B., Zekusic S. (1998): Geodetic-spatial system of the Republic of Croatia as the basis for GIS, Proceedings GIS CROATIA 98, Osijek, 24-27.

Horvat S., Zeleznjak Z., Durita I., Javorovic I. (1997): Croatian Military Cartography, Proceedings 18th ICA/ACI International Cartographic Conference, Volume 4, Stockholm, 1946-1956.

Malic B. (1998): Physiologische und technische Aspekte kartographischer Bildschirmivisualisierung, Inaugural-Dissertation zur Erlangung des Grades Doktor -Ingenieur, Hohen Landwirtschaftlichen Fakultat der Rheinischen Friedrich-Wilhelms-Universitat zu Bonn, Bonn.

Kusan V. (1996): Mapping of Forests by Means of LANDSAT TM Satellite Images. Doctoral thesis, Faculty of Forestry, University of Zagreb, Zagreb (in Croatian).

Paj R. (1998): Conception and organisation of the official topographic and cartographic information system of the Republic of Croatia (STOKIS), Proceedings GIS CROATIA 98, Osijek, 185-187.

Petek T., Podobnikar M. (1997): National Maps and Databases in Slovenia, Proceedings 18th ICA/ACI International Cartographic Conference, Volume 4, Stockholm, 2178-2186.

Petrovic D. (1998): Establishment of a System of National Topographic Databases and Maps at 1:50000 and 1:25000 scales, Geodetski vestnik 3, Ljubljana, 252-261.

Radovan D., Petrovic D. (1998): Unsolved problems of Slovenia's topographic-cartographic system, Geodetski vestnik 3, Ljubljana, 319-325 (in Slovenian).