FUNCTIONS, CONTENT AND IMPORTANCE OF MIDDLE SCALE TOPOGRAPHIC MAPS INPROCESS OF BUILDING GEOGRAPHIC INFORMATION SYSTEMS

Ing. Jaroslav PIROH CSc., Topographic Institute of SR Army Banská Bystrica, Slovak Republic

ABSTRACT

This article deals with coexistence problems of standard military middle scale maps and GIS. It introduces some undoubted precedences and advantages of the new modern forms of information about territory. It is necessary to state that standard military middle scale maps in these new conditions will be used in practice very long time. However, mutual influence between GIS and these maps is expected, as well as changes in map content, form and used technologies. Problems of a relation between military middle scale maps and GIS are very actual in all highly developed countries around the world, that is why would be feasible to respect that fact.

1 INTRODUCTION

Demands for information about all human activities has been enhanced since it can be seen immense growth of knowledge in every scientific branch.

Nowadays, information about territory is a very important article, mainly in the process of planning, ecology, power engineering, but also in other branches. It is important, that requirements on quality and content of this information are changed in dependenece on complication of the tasks. Actuality becomes a very important factor for appreciation of quality and information content's authenticity.

They are known several forms of providing information about territory (texts, charts, diagrams, grahps). The most expanded form of information is the graphic one, known as a map. Production of the maps in classical way is rather sluggish and laborious. Time period between data capture in terrain and using information delineated in the final map has unfavourable impact on map content. Majority of standards evaluated quality of maps respect such criterias as accuracy, redemption of specifications, chroma, correctness of data etc. Actuality aspect has not been yet reflected into these standards [3], [4].

Increased demands on quality and content of information about territory and exposure of time factor appearing in cartography [2], [3], [4] is carried to assert a new philosophy in understanding of information about territory. Information is not static according to this representation, but highly dynamic dimension, which is unregularly changing in time. That is why information should be, except accuracy, very actual.

According to [1] on page 3 "The main criteria of the utility value of military middle scale maps for civil and military users is actual - fresh represented information".

Collection and processing of information about territory cannot be understood separately from its utilization. Data capture, processing, sorting and registration done by people in this process and application by users is continuous process. Only technology operations can differ processes of processing and application. Such understanding will considerably manipulate not only technology of information production about territory, but also planning of maintenance of big map things, which had been gradually revised.

Recently, intensive development of electronics, computer technics, computer graphics has created fine suppositions for formation and using new - digital form of information about territory and for setting up various geographic information systems (GIS). Whole process, which deals with vectorisation, processing of digital information about territory, its registration, revision, presentation, distribution and exploitation is in a rapid development at present time. More and more efficient and faster products appeared on a market recently.

It is convenient to go into some issues related to field on the boundary between theory and practice, eg.:

- exploitation of military middle scale maps in GIS conditions,
- coexistence of classical graphic and modern digital form of information and possibilities of their relationship,
- possibilities in enhancement of the utility value of middle scale maps.

2 NEW FACTORS IN PROCESS OF MAKING AND EXPLOITATION OF INFORMATION ABOUT TERRITORY

A lot of factors has influenced development of information content and form with their different course and intensity. Those factors can be devided into 3 groups [4]:

- inovating factors
- restrictive factors
- abide factors.

The most dynamic is inovating group of factors, which is reflected in the sphere of processing as well as in the sphere of exploitation of information about territory.

There are some demands on new, special information, which had not yet been delineated in maps for users. Optimal solutions, which can be acquired just by methods of modelling and optimalistion of effects on earth surface and in its neighbourhood, are demanded in solving of complicated and expensive economic, ecological and social tasks. It is necessary to make "dynamic maps" which are able to modell processes in time and to analyse results of effects in local as well as in global extent. Users' interest to plan and manage efficiently their own operations by implementation of digital maps in dependence on change in time has been increasing. Concerning this, it is extremely important actuality and truhtability of granted information.

Technical possibilities for satiation of the new users' demands have grown up in sphere of processing recently. Technical problems, characteristic for processing of information about territory (rate of work-stations, largeness of operating memory and media with large capacity), were solved very fast with good effect. Nowadays, a lot of companies are appearing with efficient products, which can cover whole area of processing and also exploitation of information about territory (navigation, position determination, mapping, analytical and digital photogrametry, raster image processing - work with aerial photographs, graphic black-and-white and colour outputs in raster and half-tone form, etc.).

Restrictive and abide factors are unique in every country by means of economic but also national and social character.

Mentioned factors define the field, in which development of information about territory is running nowadays. New requests from side of the users and wide manufacturing possibilities can make very convenient conditions for development of cartography and geodesy. Input of computer technics, informatics, cybernetics, however, spread classical geodesy and cartography to a very complicated branch. New users' requests and new wide occasions in processing of different type of data have reverse impact on theory in geodesy and cartography sciences. Theory has the tendency to adapt on them.

The main task of cartography in new conditions is not olny to fulfill daily users requests, which people do not know to name them properly, but also to adjust how their needs are going to be developed. Progress in capture and processing of information should aim in making the system able to provide information about territory to clients and merily react on every request which just arised, and, at the same time to fulfill all functions, including production of classical military middle scale graphic maps.

That is necessary to adapt very serious and scientific interdisciplinary approach in making of such systems, which has been used by the number of well-tried scientific methods (value analysis, expert adjustments - methods for objectivistation of subjective information, mathematic statistics, historic analysis, modelling, system approach etc.). At the same time is necessary to keep the principles of logic, conception, flexibility and compatibility. Development in field of geographic

information systems in the world with different aim and extent is the result of national efforts to ensure such difficult tasks.

It would be convenient cartographers' effort to build up one comlex geographic information system, which would have been able to provide all available inforamtion about territory of the whole Earth. Each nation's responsibility should recline in transversal revision of data from its own territory and in providing of accessible information to other nations. Crucial problem seems to be the integration of conjunctive standards, establishment of uniform information coding with the main result to achieve data compatibility by this way. Systems providing capture, processing and exploitation of information, do not need to be the same, hardware can originate from various producers, but results should be opened to make sure exchange of all software products. They have been made anywhere around the world. What should be finished, is a number of legislative problems like copyrights of software makers and especially defence of each nation's interests, but this is probably a political question.

Governments and national institutions dealing with information about territory should have been supervisers of this task. Creation of such information system may not be a matter of the private business sphere, while such approach has some logical reasons now. Private leads are not interested in global solutions of this task because they are motivated by another interests.

Realisation of presented ideas is very difficult, time consuming and expensive in practice. This process will wage into two stages in conditions of Slovak Republic, which are overlaping each other.

In the first stage, when maintenance and revision of mapping things has done by classical way, there are some approaches to improve map production by means of fitting modern facilities to existing technology. In the second stage, when sufficient technical equipment, standardisation and graphic outputs are expected, technology is going to be accomodated in computer technics.

3 POSITION OF TOPOGRAPHIC MAPS IN PROCESS OF BUILDING GIS

In coherence with building GIS, problem of coexistence classical military middle scale maps and GIS seems to be current task. Topographic maps more or less successfuly fulfil their functions defined in [3]. Because of growing user demands, as stated in previous chapter, GIS starts to

be able to absorb a part of functions of military middle scale maps. Probably they can accomplish them much more better. The first of all, it is a lot of details (graphic and text information) which cannot be delineated in military middle scale maps because of limited information capacity. GIS in comparison with military middle scale maps provides opportunity to carry out analysis, modelling in 3-D and the whole range of specific tasks.

Military map remains irretrievable information source in hands of final user especially in terrain, where is not convenient or possible efficient work with technics.

Existence of GIS will greatly influence content and form of military middle scale maps from now. Concerning with possibilities of obtaining special information from GIS, the content of military map can be simplified. Some of already known things (especially graphical but also names) have had general character (bridge tonnage, tree height etc.) and do not need to be presented in map. User can get them from GIS databases with much more details.

Probably very efficient is to find such group of content features which users usually consider as less important or they change fast over the time. Their presence in map contributes to fast out-of-dating. Intersection of these attributes can be implicitly expressed by "convenience coefficient for delineation to map".

"Omitting" content features which have nominal importance for user and along with that they are very float in time, simplified map will be more readable and actual (content features, which are not delineated in map do not underlie the process of out-of-dating).

On the other hand, such interferences cannot be done in intuitive way. They should be faced with serious investigation of user demands and by expert weighing of that arrangement.

Such idea has been used in moddeling of simplified military topographic map in former Topographic Service of Czechoslovak Army with the following rerults [4].

There were accomplished special tests on sufficiently large representing sample by methods of expert adjusments and matematical statisics which respect also scale of individual user needs. This test resulted to association of importance coefficients [scheme 2 and picture 1].

According to unstableness analysis of various content features from nowadays Slovak Republic and Czech Republic territory were determined coefficients of unstableness. Persistence or unstableness of content features in time [scheme 3, picture 2] indicate with major probability their values.

Furthermore, importance and unstableness coefficients have been worked out to so-called "convenience coefficients" for delineation into map [scheme 4, picture 3].

Then according to convenience coefficient the review of the content features were made and limitation was stated. Content features with less importance as chosen limitation are not placed into the map. This limitation can be chosen by various levels of asperity. Maximal level of asperity could mean in this case, that any content feature will be chosen for delineation into the map. Contrary extreme means, that all of them will be chosen. Limitation value depends on what purpose military middle scale maps are dedicated.

Explained method introduced one of the various admittance how to make effective content of military middle scale maps on dependence of GIS existence, how to renew their content actuality and to prolong period of usage.

REFERENCES

[1] BRÁZDIL, K., 1991. Information from investigation of modernization and improvement demands in military topographic maps for civil and military necessity. Year-book of topographic service, article 3, pages 1-6.

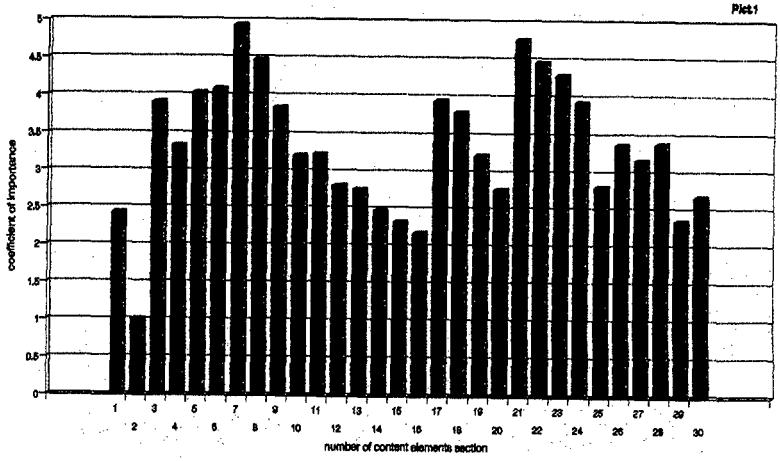
[2] KÁNSKÝ, J., PETERA, J., 1991. Expert adjustment of optimalisation demands of topographic information. Reference about results of investigation to suggest content of topographic informational system and topographic maps in coherence with preparation of their modernization. [Segmental experimental reference.] Dobruška, VS 090 58 pages.

[3] MIKLOŠÍK, F., 1987. Time as condition of work quality and efficiency in military cartography. [Doctor disertation] Brno, VAAZ 292 pages + 50 pages of enclosures.

[4] PIROH, J., 1994. Value analysis exploitation in modernization of topographic maps content [Candidate thesis work], Brno, VA 140 pages + 96 pages of enclosures.

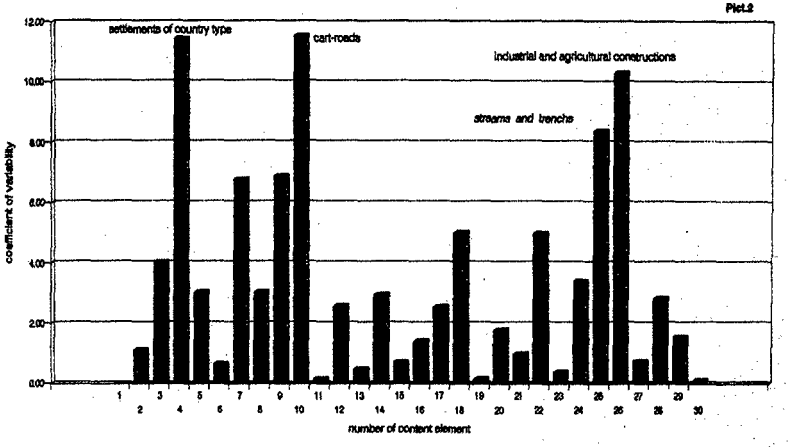
IMPORTANCE OF CONTENT ELEMENTS SECTIONS
IN TERM OF MILITARY EXPLOITATION

Pict.1

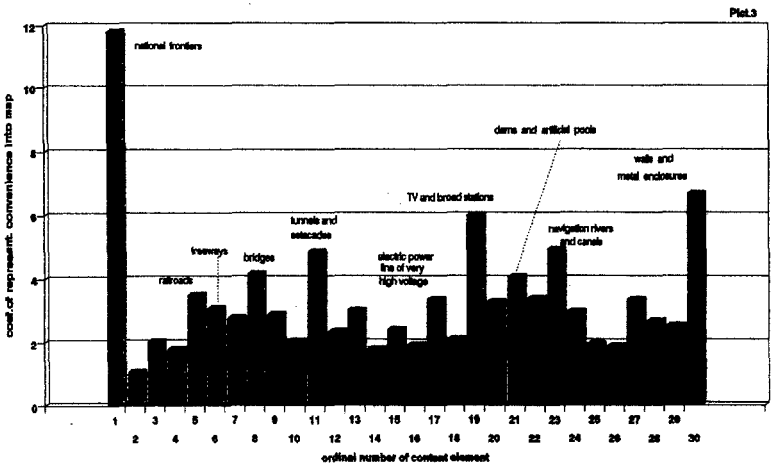


VARIABILITY OF CONTENT ELEMENTS
ON TERRITORY OF SLOVAKIA AND CZECH REP.

Pict.2



REVIEW OF CONTENT ELEMENTS ACCORDING
TO CALCULATED COEFFICIENTS OF REPRESENTATION'S CONVENIENCE INTO MAP



CONTENT ELEMENTS DIGEST

Sheet 1

ordinal number	content element
1	national frontiers
2	region frontiers
3	towns
4	settlements of country type
5	railroads
6	freeways
7	roads of the 1st, 2nd and 3rd category
8	road and railroad bridges
9	fortificated roads
10	cart-roads
11	tunnels and estacades
12	railway stations and stops
13	petroleum pipelines
14	gas pipelines
15	product pipelines

ordinal number	content element
16	remote water-pipes
17	electric power line of very high voltage
18	electric power line of high voltage
19	TV and broad stations
20	water-towers / tanks
21	dams and artificial pools
22	reservoirs and lakes
23	navigation rivers and canals
24	remaind rivers and canals
25	streams and trenchs
26	industrial and agricultural constructions
27	mining works
28	great changes in forests
29	hop-garden, vineyards and orchards
30	walls and metal enclosures

CONTENT ELEMENTS ORDER ACCORDING TO COEFFICIENT OF REPRESENTATION'S CONVENIENCE

Sheet 2

o.n.	orig. o.n.	CONTENT ELEMENT	average coeff. of represent. convenience
1	1	national frontiers	11.806
2	30	walls and metal enclosures	6.670
3	19	TV and broad stations	6.004
4	23	navigation rivers and canals	4.910
5	11	tunnels and estacades	4.828
6	8	road and railroad bridges	4.131
7	21	dams and artificial pools	4.049
8	5	railroads	3.492
9	22	reservoirs and lakes	3.365
10	17	electric power line of very high voltage	3.353
11	27	mining works	3.335
12	20	water-towers / tanks	3.240
13	6	freeways	3.085
14	13	petroleum pipelines	2.984
15	24	remaind rivers and canals	2.945

o.n.	orig. o.n.	CONTENT ELEMENT	average coeff. of represent. convenience
16	9	fortificated roads	2.846
17	7	roads of the 1st, 2nd and 3rd category	2.764
18	28	great changes in forests	2.658
19	29	hop-gardens, vineyards and orchards	2.521
20	15	product pipelines	2.383
21	12	railway stations and stops	2.312
22	18	electric power line of high voltage	2.056
23	10	cart-roads	2.018
24	3	towns	2.010
25	25	streams and trenchs	1.917
26	16	remote water-pipes	1.900
27	26	industrial and agricultural constructions	1.852
28	14	gas pipelines	1.764
29	4	settlements of country type	1.756
30	2	region frontiers	1.066