MILITARY CARTOGRAPHY AND GEOINFORMATICS - HISTORY, PRESENT AND FUTURE

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Abstract

About 250 years ago the new battle procedures discovered. By this time many wars consisted of separate battles on relatively small battlefields where the main commander was able to command his troops from one point with good observation conditions. No staffs helping him were necessary.

The experience from The Thirty Year´s war gave a suggestion of regularly armed forces creation round the whole European states. The armies stated to be bigger and regularly trained. Their troops order could be more divided during battles and thereby enable them a bigger movement on a larger area and therefore a better using of terrain properties. But the commander lost possibility to discover the entire battleground. The quality maps (mainly topographical) begun to be very important aids for success in the battle achievement. New terms of *"military mapping"* and *"military map"* begun to be used for mapping and maps prepared mainly for military users.

The development of weapons and weapons systems and changes in command and control systems can be expected in the Czech Army in the near future. New systems determine new demands on digital geographic data. These requirements can be found in the NATO and the Czech Army doctrines, development projects of electronic battlefield, projects focused on weapon and logistic systems etc.

The goal is to suggest next progress of digital spatial data and information, mainly in their content, quality, distribution methods and spatial extent. The next goal is a system of their visualisation in the Common Operational Picture suggestion, where the amount of presented information could be optimised according to a given situation.

Keywords: cartography, military cartography, historical requirements

1. Introduction in the history

About 250 years ago the new battle procedures discovered. By this time many wars consisted of separate battles on relatively small battlefields where main commander was

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able to command his troops from one point with good observation conditions. No staffs helping him were necessary and mostly some couriers carrying his orders to troops commanders helped him.

The experience from The Thirty Year´s war gave a suggestion of regularly armed forces creation round the whole European states. The armies stated to be bigger and regularly trained. Their troops order could be more divided during battles and thereby enable them a bigger movement on a larger area and therefore a better using of terrain properties. But the commander lost possibility to discover the entire battleground. The quality maps (mainly topographical) begun to be very important aids for success in the battle achievement. New terms of *"military mapping"* and *"military map"* begun to be used for mapping and maps prepared mainly for military users. This kind of maps pictured not only geographical condition. Their content was defined especially according to commanders' requirements, manners of battle procedure and weapon and weapon systems combat possibilities. Also areas of cartographic interest were usually defined in an agreement with political interest of given state.

The resulting military map quality influenced on effectiveness of weapon and troops using in a battle by return. But terms of the quality map creation and production were (and still are) not as short as impatient commanders wanted. Usually the other tasks for armies discovered during a peace time and there were either few time or few people or lack of many for military mapping. Only next war gave evidence that underestimate of military mapping was a bad decision. In the history of the former Austria-Hungry Monarchy this situation was repeated several times. Similar processes were sometimes in the former Czechoslovakia in the 20th century too. Vice versa revealed that quality military maps were useful not only for military purposes but for many civilian users mainly for state and governmental organisations.

The international political and economical changes have been established during 20th century and within this process international and cross-border co-operation have started to be very important. To support political and economical decisions the geographic information has been standardised – particularly or fully. The process of standardisation has increased since Eastern Bloc has disintegrated twenty years ago and many borders have been opened.

Several *conclusions* can be made from this very short history:

1. *The army needs own maps prepared on its demands* in an accordance with a present and near future command and control systems and weapon and weapon systems using. The similar rule is valid for digital spatial data too.

2. *The area of cartographic responsibility must be defined according to political interests* of given state or international community.

3. *Enough time, workers and money for maps* (and digital spatial data) *creation* and their up-dating are *necessary to have*.

4. *Military cartographers and database designers* must be *educated in milit*ary *branch* to be able to predict future requirements of military users.

5. *Good quality military products can be used for civilian purposes* too especially in a crises and emergency management.

2. Present changes of military users requirements

The present situation in armed forces should be seen like something unique and unusual because of a rapid growth of communication and information technologies. But this is only one view, mainly technological. Our main task continues to fulfil requirements of our users on covering a given territory by geographical data (classical or digital spatial data). The basic documents and basic trends of armed forces development are necessary to study to be able to make an appropriate decision. Several fundamental resources are for us bases which we have to respect:

- The Czech Armed Forces Doctrine in Multinational Operations [1];
- The Czech Armed Forces Doctrine in Operations on the Czech Republic Territory under National Command [2];
- Changes in command and control systems;
- Communication and information systems development;
- Weapon and weapon systems development and their using.

The *security environment* of the present world is characterised by instability and variety and thus unpredictable military threats and risks are evident. The risk of extensive military conventional attack on the Europe territory is very improbable. If this kind of attack was prepared we should have enough time to get ready for it. Unfortunately asymmetric threats escalate, mainly threats of terroristic attacks, misuse of dangerous substantives and technologies, international criminality connected mainly with drugs spreading. The potential of uncontrolled migration caused by the starvation or natural catastrophes in some countries is quite intensive. It is very difficult to be ready to solve such as this kind of threats is very difficult because of lack of time. The graph of warning time showed in the next picture (Fig. 1) can be given like a good example.

Fig. 1 Strategic Warning Source: Intelligence in Historical Perspective by M. Handel in Go Spy the Land edited by Keith Nelson and B.J.C. McKercher, Westport, CT: Praeger Publishing, 1992.

The tactics of armed forces using are changed under influences of present main threats. No very big forces are created and no large battlefields are predicted. Present military units are usually quite small and very mobile. Their main tasks are combat, of course, but sometime are quite similar to tasks of police or emergency teams. In foreign missions or in own territory the co-operation with partners is very principal. The efficiency of the operation can be limited by several factors in which belong:

- *Differences in command and control* of units participate on a given case.
- *Incompatibility of used information systems* both of technological, procedural and content point of view.
- *Incompatibility of used communication devices*.

Military geographers have to accept the unification of the operational procedures and that is why they have to be able to prepare appropriate spatial information. But our task is to define a topographical or geographical object catalogue so that this catalogue contains all object and phenomena and their thematical properties which are necessary for soldiers, commanders and staffs. DIGEST FACC and now DFDD are examples of such definitions. After the definition of all data from an *area of cartographic responsibility* it is necessary to collect, elaborate, and present them. The area of cartographic interest and responsibility of the Czech military geographers out of the Czech Republic territory is given by international agreements resulting from NATO membership and political decisions of state government and parliament. The territory of own country will stay on our responsibility too.

Commanders suppose to always have information about their position and units need good quality information about territory in which will they operate or still operate. With consideration of present military units tactics is *necessary to have more detailed information of given territory*. In the next list there are some examples:

- Light weapons including vehicles are used more frequent than not long ago when tanks, heavy artillery, and ballistic rockets were assumed to use. Units operate on no very wide battlefields. Thus *more information about micro relief* is necessary to have and provide.
- Many operations are in build-up area. The task for geographers is *to collect as many details as possible* and together with recco units and intelligence agencies participate on targets evaluation.
- The soldier of 21st century has to carry many electronic devices including systems for position determination (GPS), messages receivers and devices for terrain, targets and orders visualization. It is necessary to prepare *optimised geographic information* according to content and its transmission possibility.

The system of *the geographic support* guarantees commanders' demands from the mentioned area of cartographic responsibility. The geographic support includes data and information collection, a creation of topographical and thematical maps including city

maps and military geographic evaluations of territory. The databases in which are stored topographical, thematical, geodetical and geophysical data are created and continuously up-dated. These databases are used for above mentioned products creating.

Two basic ways are applied in the geographic support system. *Fundamental activities are provided at home* during a long period. The main productions of all military geographical products that are requested are made in the Military Geographic and Hydro meteorological Institute of The Czech Army (MGHMI). The second way is a *direct geographic support in the field*. Geographers are ready to create various types of products according to current requirements of commanders –special types of maps with a content corresponding with current situation in the given area (e.g. the maps of the division of nationalities, religions, military roads and tracks etc.). Basic databases added by data extracted from satellite images (with a possibility to use results from the unmanned aerial vehicles – UAV), results of reconnaissance of recco units (special, artillery…) are usually used. The deployable set was prepared for this kind of direct geographic support (Fig. 2). The set is equipped by commercial software and hardware and jointed with central databases in MGHMI through the satellite connection.

The geographic support does not change the command and control system fundaments, but gives the commanders more information and details about terrain characteristics and main conditions (including hydro meteorological) in a given area of activities and thus increases the efficiency of the decision making process. The main task is to prepare *the complex bases of influences of terrain, meteorological and hydrological parameters of environment on military activities* – combat activities, movement, physical and psychical condition of soldiers, logistics etc.

The complex understanding of area of interest demands to collect as many data as possible. These data are not only about *local natural conditions* (rivers, mountains, woods, deserts, climate, current weather…), but also about *local social and economical conditions too* – nationality, religion, quality of life, economical and political conditions etc. The economical infrastructure and its critical objects are very important too. This unique information can be integrated into a view on the territory called *the Recognised Environmental Picture (REP)*. REP is used like a base for display of combat situation. Portrayal of REP and combat situation is called *the Common Operational Picture (COP)*.

Fig. 2 Deployable set of the direct geographic support - SOUMOP

The information included in REP is not only the information about natural and social conditions in a given area. The influence on military activities is evaluated and presented in the REP – e.g. the influence of slopes, soils, woods etc. on a movement, camouflage conditions, a visibility and hidden places, conditions for a signal network creation, a key terrain for fight, defence etc. All information has to be regularly up-dated and immediately presented including geographical and hydro meteorological information during actions. The sources of information have to be carefully evaluated because of time limit for their exploitation. Next criteria are used for this evaluation (sort by level of importance):

1. *Accuracy* – information carries true data about situation with given accuracy.
2. *Well- time* – information is not out-of-date.
3. *Usability* – information (data) have to be in the given format and readable in all command and control systems.
4. *Fullness* – information contains all data are necessary for decision making process.
5. *Punctuality* – information contains data with required details.
6. *Reliability* – information is not distorted and its source is reliable.

In the case we don´t have enough time or possibilities to have all sources we need, other rules could be accepted:

- Incomplete or too less detailed information is better than no information, but the user has to obtain a message about it.
- Information coming beyond on given time is the same as to have no information.
- Unimportant information or confused information is worst that no information.

The *visualization of geographic and thematic information* (mainly military) is very important, too. The good quality system of visualization enables to commander to have view of all area with the most important information he needs. The view should be focused on main terrain features and their properties, own and enemy´s advantages and disadvantages, threats etc.

Graphical information is also used for command and control subordinated units and parts of staff. Graphical information is very frequently used also like an order and therefore has to be clear, unique, with substantial objects and phenomena, but without unnecessary details.

Present devices and tools of communication and information systems enable to create such pictures that are prepared with accordance to given situation and optimised according commander requirements. No the same picture could to receive everyone at the command post. The commander of artillery can receive more details about targets, obstacles, and visibilities etc., the commander of engineers will require more details about movement obstacles, hydrology, and woods like a source of building materials… The commander can have basic information from the whole area of interest with possibility to obtain details if necessary. In all cases needless information can be reduced but with possibility to have a more detailed view if it is necessary. A *system of dynamic visualization* can be used like a useful approach to the solution of this type of tasks [3].

3. Non combat operation and co-oporation with civilian emergency systems

The main tasks of the Czech Army are combat tasks and training for that. In the case of non military threat of wide extent that would be on the territory of the republic, the Czech Army would be incorporated into the Integrated Emergency System (IES). Six presumable scenarios were approved by the Czech Republic Government for armed forces:

1. *Low violation of wide range* (terrorism, great criminality, democratic fundamental of state violation).
2. *Big migration* from foreign countries.
3. *Huge floods*.
4. *Industrial accident of wide range* with chemical, biological or radiation risks.
5. *Extensive wood fires*.
6. *Extensive epidemics* of inhabitants or *epizootic* of animals.

The solution of the co-operation with other partners in IES is very important in these scenarios. The co-operation does not mean that one partner knows all about the other partners. Clear and strict rules should have to be negotiated in advance and after the negotiations these rules have to be approved by all partners taking part on solution of crises situation. Every part of IES usually has own procedures supported by geographical and thematical data which could not be readable for the other partners. To have a *real integrated emergency system* the similar rules for geographical and other spatial data similar to the allied armed forces should have to be accepted:

- *Only one positioning system* for all positioning services (the same geodetical fundaments – datum, the same projection, the same reference system if is it necessary).
- *Only one system of elevation*.
- *The same object catalogue* describing all types of geographical objects and phenomena.

- *The same sources of thematical information* and the same system of their implementation in geographical databases, if necessary.
- *The same* or similar *system of spatial data visualization*.

When these rules are not followed big mistakes could appear. For example we have two sets state´s maps and basic topographical databases – civilian and military in the Czech Republic. The datum and the projection of these products are completely different – the civilian datum is based on the Bessel spheroid and has Krovak projection (Lambert conformal conic projection in an oblique position), the military datum is WGS84 and the projection is UTM. Than the same object have two pairs of co-ordinates which are fully different. Only elevations are in the same system. If co-operating parts work in different systems, principal mistakes could occur and it could cause irreparable damages. The similar situation is in cross-border co-operation.

4. Conclusion

Not all ideas mentioned in the previous text are applied in the Military Geographic Service of the Czech Army, yet. Time to time there are some restrictions (mainly financial) that limit our development. But main principles mentioned in the text are carefully judged and according to possibilities also applied into practice.

Acknowledgement

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