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CENTRAL INTELLIGENCE AGENCY
WASHINGTON, D.C. 20505

7 June 1978

MEMORANDUM FOR: The Director of Central Intelligence
FROM : John N. McMahon
Deputy Director for Operations
SUBJECT : MILITARY THOUGHT (USSR): The Topographic
Map as a Means of Troop Control

1. The enclosed Intelligence Information Special Report is part of a series now in preparation based on the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought". This article examines the role and importance of topographic maps for reliable troop control, and indicates various measures taken to improve their quality. These include producing maps on a single coordinate system, increasing their accuracy, providing for up-to-date, complete, and detailed representation of terrain elements, and increasing the clarity, readability and durability of topographic maps. Also mentioned briefly is the development of perspective maps of water lines. This article appeared in Issue No. 2 (78) for 1966.

2. Because the source of this report is extremely sensitive, this document should be handled on a strict need-to-know basis within recipient agencies. For ease of reference, reports from this publication have been assigned

JOHN N. MCMAHON

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Intelligence Information Special Report

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COUNTRY USSR

[Redacted]

DATE OF
INFO. Mid-1966

DATE
7 June 1978

SUBJECT

MILITARY THOUGHT (USSR): The Topographic Map as a
Means of Troop Control

SOURCE Documentary

Summary:

The following report is a translation from Russian of an article which appeared in Issue No. 2 (78) for 1966 of the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought". The authors of this article are Colonel A. Krivoruchko and Lieutenant Colonel N. Ostroukhov. This article examines the role and importance of topographic maps for reliable troop control, and indicates various measures taken to improve their quality. These include producing maps on a single coordinate system, increasing their accuracy, providing for up-to-date, complete, and detailed representation of terrain elements, and increasing the clarity, readability and durability of topographic maps. Also mentioned briefly is the development of perspective maps of water lines.

End of Summary

[Redacted] Comment:

The SECRET version of Military Thought was published three times annually and was distributed down to the level of division commander. It reportedly ceased publication at the end of 1970.

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The Topographic Map as a Means of Troop Control

by

Colonel A. KRIVORUCHKO
Lieutenant Colonel N. OSTROUKHOV

In the process of troop control, when carrying out any sort of combat task, topographic maps of different scales find wide application. They are also necessary when explaining a task or the aim of an operation (battle) and during all of the subsequent work of commanders, staffs, and services involved in evaluating a situation, adopting a decision, assigning combat tasks to the troops, planning combat actions, organizing cooperation and support, and monitoring the course of fulfilment by the troops of their assigned tasks.

In evaluating a situation and determining the concept of an offensive operation, for example, the topographic map is used to study the nature of the terrain in the zone of operations of a formation, especially on the axis of the main attack, and to show the influence of the terrain on the employment of nuclear weapons (selection of ground zeroes and altitudes for nuclear bursts), on troop disposition and actions, and on rates of troop advance. The map contains information necessary for adopting a decision on the employment of the branch arms, the establishment of a grouping and the distribution of efforts, the selection of the shortest axes providing for a rapid advance of our troops and maximal exploitation of the effects of our own nuclear strikes, etc.

The topographic map is of substantial importance in working out a system of measures to protect troops from weapons of mass destruction. The forecasting of zones (areas) of destruction, radioactive and chemical contamination, floods, and fires; the determination of the protective properties of the terrain; the selection of roads for maneuvering: all of these may be performed on topographic maps. The prompt and accurate registration of these data makes it possible to make necessary changes in the grouping of troops, to precisely define the tasks

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carried out by them, etc.

The varied and highly valuable terrain information expressed on topographic maps can also be used in automated control systems. Experience has shown the feasibility of formalizing such information and inputting it into electronic computers for storage, processing, and outputting to staffs and troops in the required form and volume. In automated control systems topographic maps may find application in the form of a special cartographic base reproduced on screens or illuminated displays; it is also possible to use an ordinary screen, projecting individual map sectors on it by means of a special projector. The situation on the ground and in the air is represented on these screen maps, which enables commanders and staffs to have a visual conception of the dynamics of combat actions. As is apparent, in this case, too, the topographic map constitutes the basis without which it is impossible to obtain a spatial representation of the position of the opposing sides and, consequently, to control troops in a modern battle (operation).

Thus there is every basis to regard the topographic map as one of the necessary and very important means of troop control.

In scale, accuracy, content, and graphic and color design, the topographic and special maps with which the troops are supplied correspond basically to the demands made upon them. However, as changes occur in the nature and methods of armed combat, they, like all other technical control means, also require constant improvement.

Further improvement in the quality of topographic maps, to which great importance is attached in our armed forces, is proceeding along the following basic lines:

- improvement of the mathematical base and increase in accuracy;
- provision for up-to-date, complete, and detailed representation of the terrain elements;
- increase of the clarity, easy readability, and "durability" of maps.

By improvement of the mathematical base is meant first and foremost producing on a single coordinate system all of the maps



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with which the Armed Forces are equipped; up to the present time, we have still not succeeded in implementing this with the necessary accuracy for some remote regions. The issuing of maps in a single coordinate system for all of the most important regions will make it possible to substantially simplify the fulfilment of numerous troop control tasks (for example, the determination of target coordinates, target indication, and others).

The accuracy of topographic maps is determined not only by the reliability of the geodetic relationships between the territories which they cover and the territory of the USSR, but also by the accuracy with which objects and contours are plotted with relation to the points of the geodetic network. Thus, topographic maps with scales of 1:100,000 and larger must provide for tying in battle formations of operational-tactical and tactical missiles, artillery, radiotechnical means, and reconnaissance means to an accuracy of not less than 100 meters. The 1:200,000-scale map must allow for determining target coordinates for strategic, operational-tactical, and tactical missiles to an accuracy on the order of 200 meters.

In recent years work has been conducted to discover ways of reducing the time and increasing the accuracy of determining coordinates (geodetic and grid) on a map. It has been declared necessary, on maps with scales of 1:100,000 and larger, to show (as a supplement to the grid system) the terminations of the geographic system down to one minute, and on maps of 1:100,000-scale and larger -- to divide the minutes marked on the border into additional segments equal to ten seconds.

By completeness of content of a map is meant plotting the maximum amount of different information on it, within the limits allowed by the scale, and also detail in the representation of the principal terrain elements and their quantitative and qualitative characteristics. Improvement of a map in this regard is provided for by selecting the most essential characteristics, by depicting reference points more clearly and graphically, and by excluding secondary objects which have lost their significance under the conditions of modern combat. This work is being systematically carried out. Thus, in 1962 and 1963, the conventional signs used on topographic maps with scales of 1:25,000, 1:50,000, and 1:100,000 were reviewed and brought into

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conformity with present-day troop requirements. Fundamental changes have been introduced into the representation of population centers: densely built-up blocks of cities having over 50,000 inhabitants have come to be distinguished on the 1:50,000-scale map according to the prevailing fire resistance of the buildings, by means of background coloring, showing only the particularly noticeable buildings and industrial installations. On the 1:100,000-scale map the fire resistance of structures is not shown, but a color background is used to distinguish densely built-up blocks in cities numbering more than 50,000 inhabitants. On maps of these scales, the representation of all types of railroads is simplified, more detailed characteristics are given for motor roads of the top grades, and the color and particularly the graphic design are improved.

The content of the 1:200,000-scale map has been considerably enriched in recent years; greater detail has been introduced in characterizing the most important road and hydrotechnical installations and also water obstacles and the immediate approaches to them. In order to supplement the map with information which cannot be represented graphically or requires more detailed characterization (the nature and depth of soil freezing, the depth of the water table, seasonal terrain changes, passability of forests, climatic conditions, and others), a summary of the terrain is given on the margins of each sheet. However, experience has shown that the practical use of such a summary involves certain difficulties, because it is cut off when maps are glued together. It has accordingly been declared advisable to print such summaries on the reverse side of the map.

Fundamental changes have been introduced into the content of the 1:500,000-scale map. These changes amount to reducing the content by eliminating settlements with fewer than 200 inhabitants, representing important operational-tactical targets and air navigation (especially radar) reference points more clearly and visibly, plotting a system of grid coordinates, and increasing the number of characteristics for certain elements of the content.

Ensuring that topographic maps are up-to-date. By up-to-date is meant the degree to which the geographical objects represented on a topographic map correspond to their actual condition. The discrepancy between one and the same elements of



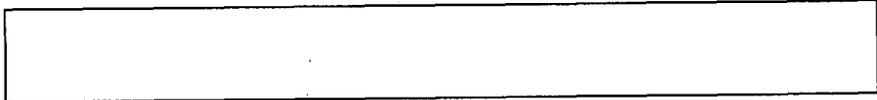
the terrain and the map has come to be called the obsolescence of a map. Obsolescence of a map occurs as a result of human activity and the forces of nature, beginning the moment surveying is completed. There are virtually no topographic maps which correspond to terrain at a given moment, since a certain period of time is required for drafting and publishing the map after completion of the surveying. However, a map retains its importance as a source of valuable information if it corresponds to the terrain with regard to the main elements and objects exerting the most fundamental influence on the correctness of the evaluation of terrain and troop activity.

Maps also obsolesce "mentally". This occurs as a result of technical improvement of the methods of representing terrain and of changes in troop requirements on the content and design of maps (the introduction of new conventional signs and the elimination of outdated signs, improvement in their graphic rendering, improvement of their color design, etc.). And this too requires their systematic renewal.

The renewal of maps means bringing outdated maps, with which troops are supplied, into conformity with the terrain, as a result of which there is not only a change in the content of the map, but its external appearance is brought into conformity with the currently valid conventional signs. The periodicity of renewal depends on the importance of the territories, the nature of the changes, and also the availability of cartographic materials.

Many years of experience indicate that renewal of topographic maps of 1:50,000-scale to 1:200,000-scale for the territory of the European Theater of Military Operations must take place every five years, and for other territories every eight to ten years. The renewal of maps is a very complex task. Thus, a 1:100,000-scale map of the territory of the USSR includes about 17,000 titled sheets, while the Soviet Army in fact uses topographic maps of six scales (not counting special maps).

In view of the fact that the period between the preparation and renewal of a map lasts several years, some of its sheets may become very outdated, which will make it difficult to use them. In these cases, an operational correction is made in which only the main elements of the map content are brought into conformity



with the terrain, by introducing, into part of the edition, the corrections (overprinting) necessary for troop combat training.

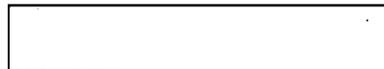
In addition to this, systematic work is being conducted to produce new types of maps. Thus, over recent years, there have been produced and adopted as standard equipment a 1:1,000,000-scale air map, a 1:2,000,000-scale aerial navigation map, a perspective map of water lines and a series of other lines -- for special purposes.

On the 1:1,000,000-scale aerial map, background coloring is used to set off cities with a population over 50,000, the network of lowest grade roads is considerably thinned out, the number of population centers represented on the map is decreased by about 30 percent, and the accuracy of plotting the elements of the hydrographic network, town contours, and large tracts of forest has been increased. The 1:2,000,000-scale aerial navigation map (although it is produced on the previous coordinate system) has overlap areas outside the map borders, amplifying the sheets to a rectangle, which makes it unnecessary to glue sheets together when laying out march routes; the content of this map is freed of objects which cannot be used as reference points at modern flight speeds; other improvements are introduced making it possible to produce a clear, easily-read map with the principal objects well set off.

A completely new type of map is the perspective map of water lines, which is produced for large water obstacles. The water surface, with all of the existing crossings, hydrotechnical and road works, and convenient sectors for assault crossing, are shown on the map on a scale of 1:20,000 and the nearest approaches to the river -- on a scale of 1:100,000. In addition, detailed characteristics of all installations on the river are presented in a special table, information on the condition of the approaches and a detailed description of them are shown in the summary, and photographs of vital road and hydrotechnical works are placed in the margins.

Completely new maps are produced for automated control systems, for supporting space flights, for an atlas of average winds, fields of radar invisibility, and many others.





Clarity, easy readability, and durability of topographic maps acquire special importance under modern conditions: these factors determine the expenditure of time for obtaining from the maps the terrain information needed to evaluate a situation and to adopt a decision, as well as the durability of the maps and the possibility of using them under different climatic conditions.

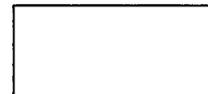
Clarity and easy readability of maps are achieved by constant improvement of the conventional signs and by the most rational representation on the maps of the information required by staffs and troops in line with the tasks they are to fulfil.

Extending the working life of maps is provided for mainly by increasing the strength and wear-resistance of cartographic papers by introducing resin, latex, and other fillers into ordinary cellulose papers. Experiments have shown that the addition of fillers made of polyamid (capron) or polyethylene-terephthalate (dacron) resins sharply increases the strength of cellulose paper. Maps printed on this paper are not inferior to maps with cloth backing.

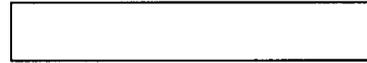
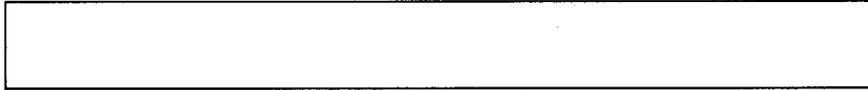
It has recently become a considerably more widespread practice to glue various types of films onto maps, the most suitable film being the imported "Mitsofol" with an adhesive coating. The technology of obtaining such film is already being mastered by domestic industries.

Consideration of the importance of topographic maps for troop control makes completely obvious the need for the military topographic service to establish, in advance, supplies of up-to-date topographic and special maps and of catalogues of coordinates of geodetic points, in quantities providing fully for troop needs, and their systematic improvement taking into account the development of the means and methods of armed combat.

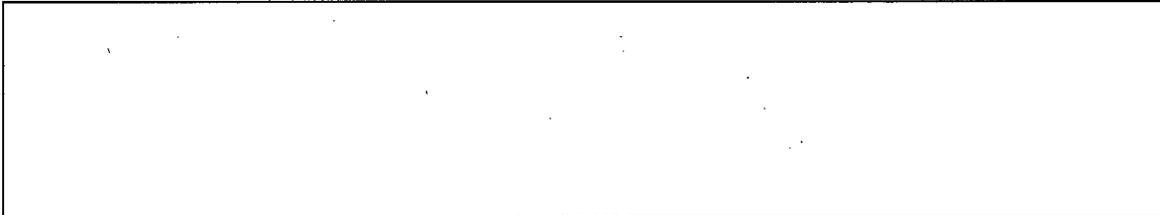
Another equally important task is that staffs and troops be able to exploit all of the terrain information on a map thoroughly and in a short time. It follows from this that it is necessary to constantly improve the skills of commanders and staffs in working with topographic maps under different situational conditions.



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