A SEMIOTIC APPROACH TO RUSSIAN MILITARY

MAP SYMBOLOGY AND TERMS

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ABSTRACT

Modern Russian military maps may comprise any combination of over 1,000 map symbols and 3,000 Russian terms. These symbols and terms identify tangible aspects such as locations, unit/equipment type, numbers, etc., but some symbols, and groupings of symbols, can also denote more subjective aspects such as movement over time, types of maneuvers, relationship to the surrounding environment and other activities or conditions. Due to very different military organizational systems, doctrinal semantic stylization, and broader cultural tendencies, those unfamiliar with Russian maps can misinterpret the intended meaning of these symbols and terms.

Attempting to accurately interpret and organize Russian map symbology and terms raise questions about cognition and the basic processes of how humans interpret information. A potential pathway to answering these questions is through the application of semiotics—the study of signs and the process through which they produce meaning. This study has leveraged the works of the pioneering theorists of semiotics, Charles Sanders Peirce and Ferdinand de Saussure, and their successors in the relatively new field of cartosemiotics—the use of semiotic methodologies to create, understand and apply cartographic representations.

Specifically, cartosemiotics facilitates the understanding of map symbolism; the type of sign systems that are found in maps; the processes through which humans understand cartographic signs; and the context in which cartographic sign systems and sign processes are embedded.

This study demonstrates a semiotic-based system for describing Russian military map symbols, associated terms, which are often expressed in the form of an acronym, and how they depict activities in time and space, which can be easily understood and queried by a person unfamiliar with the Russian language and military symbology through the application of appropriate categorization and a relational database. In particular, this system proffers a cartosemiotic approach that captures the meaning of these symbols, as was intended by the Russian map makers who created them. This study finds that a semiotic approach is not only effective for organizing Russian military map symbology and terms but that the process of categorization and organization of these symbols and terms can reveal otherwise hidden knowledge about the phenomena that they represent.

APPROVAL PAGE

The faculty listed below, appointed by the Dean of the School of Graduate Studies, have examined a dissertation titled "A Semiotic Approach to Russian Military Map Symbology and Terms," presented by Charles Kelly Bartles, candidate for the Doctor of Philosophy degree and hereby certify that in their opinion it is worthy of acceptance.

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ABBREVIATIONS

BMDS	Ballistic Missile Defense System
CNRS	National Centre for Scientific Research
COFM	Correlation of Forces and Means
CWM	commander’s working map
DP	decision point
EHESS	École des hautes études en sciences sociales
EPHE	École pratique des hautes etudes
GF	Ground Forces
GIS	Geospatial Information System
NATO	North Atlantic Treaty Organization
NKVD	People's Commissariat for Internal Affairs
OMON	Special Purpose Police Units
RVSN	Strategic Rocket Forces
SOBR	Special Rapid Response Detachments
SOSI	space object surveillance and identification
SQL	structured query language
TMS	Tartu–Moscow Semiotic School
UAV	unmanned aerial vehicles
UGV	unmanned ground vehicles
US	United States of America
VDV	Airborne Troops
VKS	Aerospace Forces

VMF	Navy
VV	Internal Troops
XML	extensible markup language

CHAPTER 1

INTRODUCTION

> It is curious that although maps can only function through the use of signs, so little attention has been given to their characteristics and organization. Yet a basic understanding of how signs on a map operate is essential to both making and using maps, and a proper appreciation of this would remove a great deal of confusion both in describing maps and in discussing problems of map use. In particular, the distinction between what the map actually states, and what the user interprets, is often misunderstood. (Keates, 1996, p. 79)

Russian military map symbology and terminology are nested firmly within the long-standing Russian tradition of cartography. But to describe military map symbology and terminology simply as a development from civilian cartography would be inaccurate. From its inception, Russian cartography itself has been envisioned to be of primary benefit to the State, including the support of military operations. Although it can be argued that maps are essential for any nation engaged in military operations, maps have historically been much more important for Russia. The country is a vast landmass with wide plains at many of its borders that have facilitated Russia's rapid expansion throughout its history. But these same wide plains have provided easy avenues of approach for an assortment of invaders ranging from Mongols, Turks, Japanese, Swedes, Polish/Lithuanians, Teutonic Knights, and most recently Nazi Germany.

To defend the vast landmass that is Russia, Imperial Russia, the Soviet Union, and now the Russian Federation employed, and employs, an outstanding group of cartographers, geodesists, and surveyors to map the world and store information via cartography. This tradition has carried over to modern Russian military maps which

comprise of topographic maps overlaid with any combination of over 1,000 map symbols and 3,000 Russian terms. Although it can be argued that topography is as much an art as a science, understanding Russian military map symbology and terms is much more subjective, and so more prone to misinterpretation by Western readers. This tendency is due to very different military organizational systems, doctrinal semantic stylization, and broader cultural tendencies. The consequences for such misinterpretations are far more than an academic problem, as the misunderstanding of the size and disposition of forces can lead to miscalculations about the overall intent of Russian forces. The West is already at loggerheads with Russia over a variety of issues ranging from military incursions in Syria; Russian military activities in Crimea and Eastern Ukraine; the US placement of Ballistic Missile Defense System (BMDS) infrastructure in Poland and Romania; and the Russian rejection of the perceived imposition of Western values (freedom of the press, gay rights, promotion of liberal democracy, etc.). Miscalculations at a time when relations between Russia and the West are arguably at their lowest point, since even the doldrums of the Cold War, create the possibility that the misunderstanding of Russian military map symbology and terminology could exacerbate tensions leading the US and the West further down the path of military conflict. This is especially the case as these symbols and terms are the representations used for the calculus of military response, or the correlation of forces and means (COFM), as opposing forces often attempt to deter each other by way of military capabilities and forces.

Background

Early History

The relationship between the State and geography is an old one in Russia, but before proceeding, there should be some explanation of the term 'geography', as the use of the term had a connotation different than today. In early Russia, as elsewhere in Europe, geography had a narrower definition than today that included just the applied sciences of earth measurement related to mathematics and astronomy such as geodesy, cartography, navigation, and surveying. Given this definition, geography was purely a technical endeavor and did not have the current broader definition as the study of place, space, and the environment. This means that activities such as geographic exploration and regional studies were not considered as part of the discipline of geography (Shaw, 1996, p. 161). It should be noted that this was a time before the social sciences (psychology, economics, political science, history, and demography, etc.), were viewed as discrete disciplines (*Wissenschaft*) (Ross, 1991). This is pertinent because geographic exploration and regional studies were important means of collecting and storing this social science data, and as the discipline of geography matured into its current form some of this information would continue to be captured by cartographic representations.

As early as the ninth century, descriptions of Russia as a geographical entity began to appear in early Russian texts. The early Russians' interest in these matters is unsurprising, as Russia was an agrarian society with land being the main source of wealth, so the surveying and marking of territorial boundaries were of high importance. The oldest known archeological artifacts attesting to Russia's cartographic history have been

dated to the eleventh century. These matters were so important, that Russia's first legal code, The Charter of Vladimir Vsevolodovich (*Ustav Vladimira Vsevolodovicha*), contained several provisions governing the removal of boundary markers. Perhaps the best-known example of early Russian geographical and cartographic awareness is the Tale of Bygone Years (*Povest vremennykh let*), or as it is more commonly referred to in English, the Russian Primary Chronicle, compiled in 1113. This narrative of early Russian history made it clear that the authors not only had substantial geographic knowledge, but also that geography, and cartography, in particular, were of keen interest to the State (Postnikov, 2000, pp. 1-3). A noted scholar on the history of Russian geography and cartography, and Russian Academy of Sciences member, Alexey V. Postnikov, points out that early Russian cartography had four key purposes that would eventually fuse into a national cartographic tradition.

> In Old Russia these four types of practical cartography developed relatively independently from each other, but each of these types gave impetus to the characteristic skills and methods that would subsequently be combined into a national cartographic tradition. These early cartographic representations, however diverse they were, had at least four key purposes: (1) to enable people to find their way and to represent natural and man-made routes; (2) to show the boundaries between private land holdings and, later, between tribes and early state frontiers; (3) to depict fortresses and urbanized territories or settlements; and (4) to represent graphically, sometimes by cartographic declaration, the territories of states as a whole. In addition to these four practical purposes, early peoples also developed general, conceptual cartography, which constituted an integral part of their cosmography and understanding of the world. (Postnikov, 2000, pp. 1-2)

The use of cartographic representations as repositories of knowledge, and the government's desire to limit access and control these repositories would become a recurring theme in Russian cartography (Postnikov, 2002, p. 243). Drastic restrictions

were imposed on compiling, publishing, and using large-scale maps. Although the protection of cartographic information was a common feature in most governments at the time for economic and military reasons, few states guarded cartographic information as zealously as the Russians. As Valerie Kivelson states, "rather than encourage the collection and circulation of information, the Russian State preferred to monopolise both of these spheres of activity and to quash communication" (Kivelson, 2006, p. 24).

Peter the Great

Emperor Peter the Great (1672-1725) was perhaps Russia's greatest statesmen, organizer, modernizer, and military reformer. The Russia that Peter inherited upon taking the throne was an isolated and underdeveloped backwater compared to elsewhere in Europe. This lack of development has been attributed to several factors including geographical location, limited access to the sea, and the Mongol-Tatar yoke which subjected Russia to foreign domination from the 13th to the 15th century, retarding development. But arguably, Orthodox Christianity, acquired from Byzantium, was Russia's biggest impediment to the acceptance of new ideas stemming from the Renaissance and the Scientific Revolution, as Orthodoxy's conservative nature made the acceptance of foreign ideas difficult. Since this conservative nature inhibited the importation, and even the domestic development, of new ideas, Russia was still relying upon the intellectual achievements of Byzantium, well into the 17th century (Shaw, 1996, pp. 161-162).

> As late as the seventeenth century, for example, the views of the eighth-century writer John of Damascus were widely regarded as authoritative on matters concerning theology, science, philosophy and other intellectual pursuits. Works like the Hexaemeron of the fourth-century writer St Basil,

> a treatise on the six days of creation which also draws on Aristotle and Pliny, and the sixth-century Christian Topography of Cosmas Indicopleustes, were similarly deemed trustworthy. Those who openly opposed such teaching, or who propagated foreign ideas, were liable to be condemned as heretics. (Shaw, 1996, p. 162)

Due to a turbulent political situation in Russia, Peter was raised away from the Russian court. This unconventional upbringing for a Russian ruler gave Peter a great deal of exposure to Western European culture and was likely the impetus for his "Grand Embassy" (1697-1698) to Western Europe. The "Grand Embassy" was a diplomatic and economic mission, consisting of 250 personnel lead by Peter to Holland and England, with the intent of garnering support for his campaigns against the Ottoman Empire and strengthening economic ties with the West. Peter had no desire to 'Westernize' Russia, he simply wanted to modernize the government, economy, and military to better compete with the other great states of the day. While abroad, Peter not only worked as a shipbuilder and craftsman but also recruited a great many scientists, technicians, and craftsman, to work in Russia (Hughes, 2002, pp. 6-57). Some of these skilled craftsmen included geodesists, surveyors, and cartographers, as Peter came to believe that a complete geographical survey of the Russian Empire was essential for a modern and strong State (Shaw, 1996, p. 165).

Upon arriving in Russia, these foreign geographers must have found the task of raising Russian geographic standards to Western European levels daunting. Although Russia had a long history of employing cartographic representations, Russian geodesy, surveying, and cartography were technologically far behind the Western European standards of the time. There were some translations of Western geographic texts, such as

those by Mercator, available in Russia, but due to the Orthodox Church's control of printing, most of these texts remained in manuscript form, as the Church frowned upon these foreign ideas. Also, in the 16th century, geographical representations of Asiatic Russia (East of the Urals) began to appear as Russia expanded to the South and East (Shaw, 1996, pp. 163-164). But Russian geographic knowledge was still in its infancy, and would have to grow dramatically to meet Peter the Great's vision of Russia as a powerful and modern state, as "land survey and mapmaking have been noted as vital instruments in the pacifying, ordering and vitalizing functions of the state" (Shaw, 1996, p. 160).

Peter's reign brought about a flowering of Russian geographic knowledge and thought. This was accomplished not only through the recruiting of foreign geographic specialists from abroad but also by establishing academies and secular printing presses for the growing of domestic talent. According to the Soviet geographer and historian of geography Dmitry Lebedev (1892-1978), the term "geography" (*geografiya*) itself first came into use during the era of Peter the Great, as before the term "land description" (*zemleopysanye*) was simply used (Lebedev, 1950, p. 332).

> Peter's Russia strove to develop mechanisms for the collection of many kinds of statistical data and of related types of information including, as we have seen, map data. Here, of course, is where geography, statistics, demography, economics and other social sciences meet, but the whole movement was inherently spatial and provided the basis for the future geographical description and survey of the Russian state. (Shaw, 1996, p. 166)

Perhaps the greatest testament to Peter the Great's geographic exploits is that approximately 70 years after his death, the once geographically backward country was able

to produce and collect enough geographic knowledge and expertise to start its own geographic institutions and traditions. In 1796, Russia established the 'Map Depot' in Saint Petersburg to consolidate the collection, storage, and dissemination of cartographic products and topographic surveys in the interests of the Russian Army and the State. From 1801-1804, the Map Depot produced the Stolistovy map (*Stolistovaya karta*), or 'hundred-sheet map', the first detailed maps of the Russian Empire. The Stolistovy map is a set of 114 maps at a scale of 20 versts per 1 inch, or 1:840,000 (8.4 kilometers per 1 centimeter) that spanned the Russian Empire's borders at the time, from the border of Poland in the west to the Tobolsk-Khiva meridian in the east (Litvin, 2004). In 1812, five months before Napoleon Bonaparte's Grande Armée invaded Russia, the Russian Military Topographic Depot was founded, and by 1840 had published 10-verst maps (1:420,000) of most of European Russia. Davies and Kent have described the specialists of the Military Topographic Depot, and its successors as "arguably the most talented pool of geodesists, topographers, surveyors, and cartographers the world has seen" (Davies & Kent, 2017, p. 4).

By the end of Peter's reign, Russia had more geographic information about its territory than ever before, and the technological level of Russian geographic science had grown by leaps and bounds. By the nineteenth century, high geographical accuracy was becoming synonymous with the Russian cartographic tradition (Postnikov, 2002, p. 251). But some things did not change. Geographical activity continued under the government's thumb, as geographic knowledge was understood to be entwined to build a modern and strong State (Shaw, 1996, pp. 167-170). The importance of geographical thought to the

Russian State can still be seen today, as the Russian Minister of Defense, General Sergei Shoigu, is the President of the Russian Geographical Society, while the President of the Russian Federation, Vladimir Putin, is the Chairman of the Board of Trustees of the Russian Geographical Society (Russian Geographical Society, 2020).

Soviet History

If Peter the Great opened the door for Russian geographic greatness, the Soviets certainly stepped through it. In 1918, in the midst of the Russian civil war, the Soviets produced their first 1:100,000 map series. These maps were made following the International Map of the World (IMW) system proffered by German geographer Albrecht Penck in 1891. The IMW system proposed a worldwide system of maps that would consist of 2,500 1:1,000,000 map sheets, each representing 4° of latitude and 6° of longitude that would be created by the nations of the world (MapCarte 241/365, 2014). Although the project only created half of the planned 2,500 sheets, the Soviet mapping system predicated upon it, likely created millions of map sheets based upon the system, and the IMW is still the foundation for Russian maps made to the present day (Davies & Kent, 2017, p. 8). In 1921, the Soviet Union introduced standard specifications for 1:1,000,000, 1:500,000, 1:200,000, 1:100,000, 1:50,000, 1:25,000, and 1:10,000 maps, at each scale these topographic maps maps use a standard symbology, projection, and grid (Davies & Kent, 2017, pp. 3-4) (See Appendix B).

The Second World War was the impetus for more integration of militarily useful information into Russian topographic maps. In 1940, new specifications were added for Russian topographic maps, these specifications would provide far more detail than maps

created in other countries at similar scales, including types of information such as forest type, road width, and the composition of river/stream beds. After the Second World War Stalin ordered the Topographic Directorate of the General Staff of the Soviet Army (*Voyenno-Topograficheskoye Upravleniye General'nogo Shtaba Sovetskoy Armii*), the successor of the Military Topographic Depot, and the Soviet civil equivalent, the Central Administration for Geodesy and Cartography[1] to produce 1:100,000 maps for the entire Soviet Union (Postnikov, 2002, pp. 243-245). This task was completed by 1954, resulting in the creation of 13,133 map sheets (Davies & Kent, 2017, p. 8).

In terms of government control of mapping, the Soviets were initially remarkably open to commercial and even foreign involvement to attain and develop geographic information and technology. During the New Economic Policy (1921–1929), the Soviets loosened controls on surveying and mapping by permitting commercial industries to purchase needed cartographic products. From 1929-1930, the State Geodetic Survey (*Gosudarstvennaya Geodezicheskaya Syemka*) was in contact with the United States Coast and Geodetic Survey and US companies to procure new technologies. As Stalin tightened his grip on the Soviet Union, the State restricted access to geographic information and by 1935 all commercial and civil geodesy, surveying, and mapmaking had been placed under

[1] The Central Administration for Geodesy and Cartography, currently known as the Federal Agency for Geodesy and Cartography (Roskartografia), was responsible for civil cartographic needs in the Soviet Union and worked closely with the military's Topographic Directorate. Although the military was provided high-quality large-scale maps, the best maps civilians could acquire were maps based upon 1:2,500,000 map sheets, and in addition to the poor amount of detail (due to the map scale), random distortions were also added. These practices seem bizarre in the current day but were in tune with other measures of the somewhat paranoid police state that was the Soviet Union. This was a time before satellite imagery became pervasive (Postnikov, 2002, pp. 243-246). Some of this paranoia may have well been warranted, as the French had legally acquired the Map Depot's 1:840,000 Stolistovy maps used for Napoleon's 1812 invasion of Russia (Rychkov, 2006, p. 35).

the control of the People's Commissariat for Internal Affairs (NKVD). In the Soviet Union, major restrictions were placed on the compiling, publishing, and even the use of maps. Most maps were classified as 'state secrets'. Laws were so strict, that a misplaced map could result in an eight-year prison sentence. These restrictions were not lifted until 1989, during *Perestroika*, when the Topographic Service of the General Staff began to publish maps for sale to the general public (Postnikov, 2002, pp. 247-251).

Combatting the Nazis and defense of the motherland was the initial reason for the enhancement of Russian topographic map standards, but mapping was later seen as a means of achieving the longer-term Soviet goals of advancing economic development and communism. To further these ends, the Soviets endeavored to map the world, an effort that came to include many foreign cities and towns, most at 1:10,000 or 1:25,000 scales. The Soviets emplaced rigid standards for typefaces, colors, symbology, and projections, but imposed no fixed size or extents for these maps, to let the cartographer map the area in the best way he or she best-found fit. Although the Soviets launched their first imagery satellite in 1962, these maps included far more information than could (and can) be derived from remote sensing. This incredible amount of detail included militarily useful information, such as the composition of riverbeds and the height of bridges above the surface, information essential for fording and riverine operations. But it also included more mundane information, such as color schemes for three major building types (military and communications, governmental and administrative, and military-industrial), and occasionally included information such as building names and their activities. In general,

whatever information of military, political, even economic value, could be added (Davies & Kent, 2017, pp. 4-8).

It is important to note that the Soviet cartographers did not use personal computers or relational databases to practice their craft. This is much different than the way modern cartography is practiced today. Most modern cartography uses geospatial information system (GIS) technology, so digital data is simply stored on a hard drive or database and then is manipulated via a personal computer and/or web application to create a map. Digital data can be rapidly applied, combined, and altered on a computer-based map, so there is relatively little thought about what actually gets displayed on the map, as the technology allows any number of layers to be easily toggled on and off. But for the Soviets, the map *was* the database, and so a great deal of effort was required to determine which information was displayed. Since these maps are in essence repositories for geospatial and other information, some significance can be gleaned from what information the society deemed important to include, as Alexander Kent states "They [Soviet cartographers] managed to turn so much information into something that's so clear and well-presented…There are layers of visual hierarchy. What is important stands out. What isn't recedes. There's a lot that modern cartographers could learn from the way these maps were made" (Miller, 2015).

Topographic Maps and Russian Military Symbols and Terms

Maps of many scales and types are used for military purposes, but topographic maps of the 1:25,000, 1:50,000, 1:100,000, and 1:200,000 scales are the most common military maps in use. The choice of scale depends on the echelon (company, battalion,

brigade, etc.) of the unit and its combat tasks. Of these maps, the 1:100,000 map scale is most often used as it's extent and level of detail is appropriate for planning a wide variety of military operations by being sufficient for navigation, weapon employment, offensive and defensive operations, crossing water obstacles, and conducting reconnaissance. Larger scale maps (1:50,000 or 1:25,000) are used when operating in particularly difficult terrain and/or urban areas, while smaller-scale maps (1:200,000) are used for activities such as long-distance road marches (Andreev, Andreev, Gavrilov, Shmotov, & Khilenko, 2006, p. 7; Yelyushkin, 2020, p. 70). Since military symbols and terms are fleeting in nature, they have traditionally not been printed upon topographic maps. Instead, they are either drawn directly upon the map, on a clear acetate plastic overlaying the map or digitally overlaid.

Unlike topographic maps, that have a well-documented symbology system that can be traced back to the inception of Russian topography, and although military symbols (in some form) have likely been in use as long as the Russian Army has employed maps, there appears to have been no formalized system of Russian military map symbols until the interwar period (Military Topographical Directorate of the General Staff, 1983, pp. 3-4).[2] Before this time, the Russians had no standardized symbology, aside from the use of lines to show the disposition of fronts and large arrows to show the movement of forces, to depict military equipment, units, and activities on topographic maps. As can be seen in Figure 1.1, a map indicative of Russian military maps of First World War, since there was no system of symbology in use, the symbols are relatively simple and a legend was added to explain the various symbols on the map.

[2] The interwar period is generally considered to be the period of time between the end of the First World War in November 1918 and the beginning of the Second World War in September 1939.

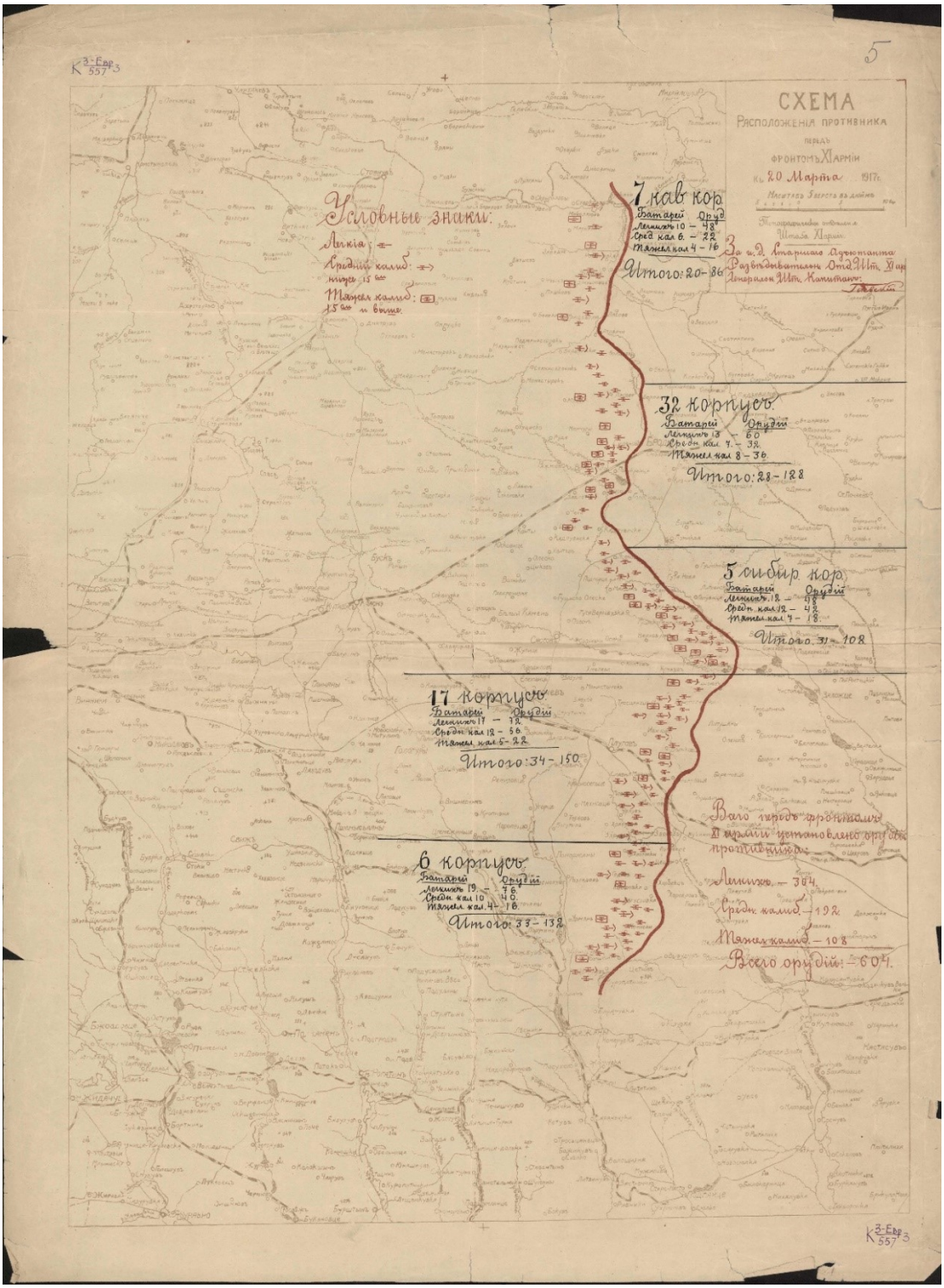

Figure 1.1. Example of First World War Russian map and military map symbology. In the public domain.

These First World War maps are in stark contrast to the maps produced in the Second World War, as maps produced in the latter era employ a large number of symbols that seldom vary despite being produced by a large number of personnel operating in many different theaters. This is because, by the beginning of the Second World War, Soviet officers were learning this system throughout their military education, indicating that military map symbols became an institutionalized phenomenon at some point between the World Wars (Gerasimov, 1943). A detailed explanation as to why the Soviet Union chose to institute a formal military map symbology system at this time is beyond the scope of this study, but is likely related to security cooperation activities between the Soviets and the Germans in the interwar period, as there are obvious similarities between Soviet and German map symbols as can be seen in Figure 1.2.[3] Russia's military map symbology system has since added many new symbols to depict the various new phenomena that have appeared on the modern battlefield, ranging from nuclear blasts to unmanned aerial vehicles. Aside from these new symbols and the occasional symbol modification, Russian military map symbology has changed very little since its inception.

[3] The 1939 Treaty of Non-aggression between Germany and the Soviet Union, more colloquially known as the Molotov–Ribbentrop Pact, is the most infamous Soviet-Nazi treaty, but it was not the most important in regards to Soviet-Nazi military cooperation, and likely Soviet military mapping. The 1922 Treaty of Rapallo signed between the Soviet Union and the German Republic not only dealt with territorial and financial claims, but it opened the door for German and Soviet military cooperation. For about 10 years, the Soviet Union and the German Republic exchanged military personnel for a myriad of programs. Although there is no definitive proof, there are clear similarities between the German and Soviet military map symbology systems, especially among the new symbols that represent the technological innovations of the interwar period. Considering the combined effects of the First World War, the Russian Revolutions (February and October), and the later Stalinist purges of the officer corps, that destroyed the Russian military's best and brightest, it is likely that aspects of German map symbology may have been borrowed along with the technological innovations.

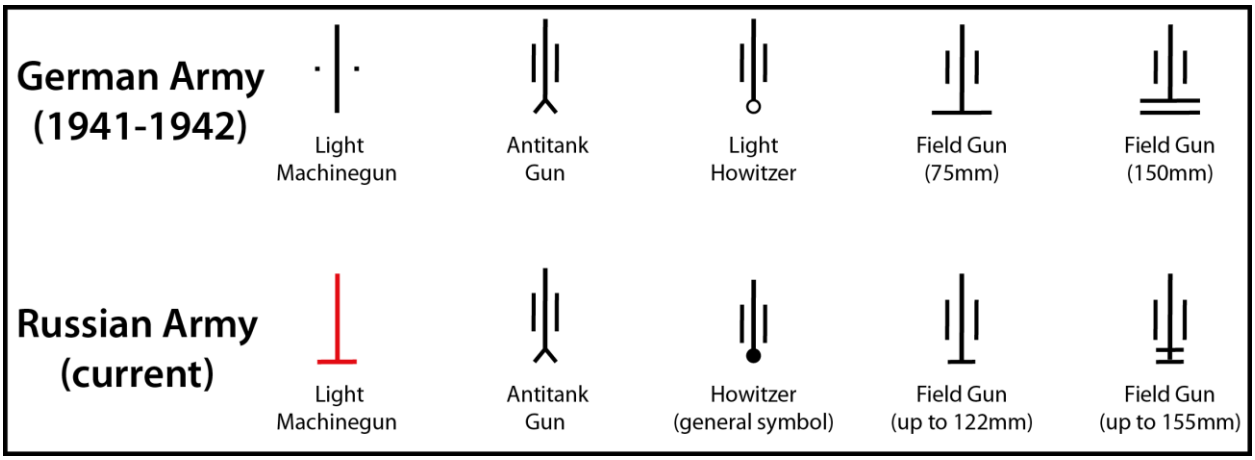

Figure 1.2. Comparison of German Republic and Russian map symbols.

From the very beginning, Russia's geographic tradition has strongly been entwined with the interests of the State. In an era before computers, these maps were designed to be repositories of geospatial information for the administration of the State, and for the conduct of military operations. Due to these reasons, Russian maps often have a level of detail far in excess of similar maps of other nations. The Russian military symbology system was developed to supplement this long-standing topographic tradition. The primary difference between Russian topographic and military symbol systems is that the topographic maps, symbols, and terms are designed for both civil and military purposes, while military symbols and terminologies are used specifically for military purposes and are overlaid upon the former. The only stylistic difference between topographic and military terminologies is that topographic terminologies rarely use acronyms, but often use abbreviations, while military terminologies rarely use abbreviations, but often use acronyms.

Purpose and Scope of Research

Until this study, there has been no system or theory for organizing Russian military map symbology and terms. While the North Atlantic Treaty Organization (NATO) uses one manual to describe its military symbology, the Russian military has no such publication. Rather, the sources of Russian military symbols and terms are scattered throughout various training publications appropriate to their respective branches of service. In addition, and unlike the NATO system which seldom uses terms (words) to depict units and activities on maps, the Russian system almost always uses a combination of terms and acronyms on maps. This means that understanding Russian maps also requires some understanding of Russian terms and acronyms, as well as the map symbology itself. The lack of an existing, readily available system for organizing the meanings of Russian military map symbology and terms makes it incredibly difficult for those unfamiliar with both the Russian language and Russian military map symbology to interpret and use Russian military maps. (Modern Russian military maps may contain any combination of well of over 1,000 map symbols and 3,000 Russian terms.) Not only do these symbols and terms identify tangible aspects such as locations, unit/equipment type, numbers, etc., but some symbols, and groupings of symbols, can also denote more subjective aspects such as movement over time, types of maneuvers, relationship to the surrounding environment and other activities or conditions.

Although a full understanding of Russian military maps would also require a detailed explanation of the Russian topographic maps upon which Russian military map symbols and terms are overlaid, this explanation is well beyond the scope of this study. As

previously mentioned, there is a long tradition of Russian topography, and there have already been several substantial efforts to make this information accessible to the West. As early as 1958, the US Army published a technical manual, *Soviet Topographic Map Symbols* (Department of the Army, 1958) about the interpretation and use of Russian topographic maps. Despite the age, much of the manual is still applicable to this day. In 2005, East View Geospatial published *Russian Military Mapping* (Psarev, 2005), the latest English language guide on the technical aspects of Russian topography. More recent scholarship by Davies and Kent has gone beyond the technical aspects of simply interpreting Russian topographic map symbols and has instead focused upon the aesthetic aspects and the use of topographic maps as repositories for information at a time before the advent of personal computers and relational databases. Russian military maps cannot be interpreted without understanding the underlying topographic subtext, but since this topic has already been well explored, this study will focus on the more obscure topic of Russian military symbology and terms.

Research Question and Objectives

How can a system of Russian map symbology and terms be organized? A system that describes Russian military map symbols, associated terms and acronyms, and how they depict activities in time and space, which can be easily understood and queried by a person unfamiliar with the Russian language and military symbology is necessary. This system must capture the meaning of these symbols not only from a Western perspective but also capture the meaning of the Russian map makers who have created them. Also, this system must be easily quarriable, and not require a knowledge of the Russian language

to employ, thereby increasing the current level of understanding of Russian symbology and terms as shown in Figure 1.3.

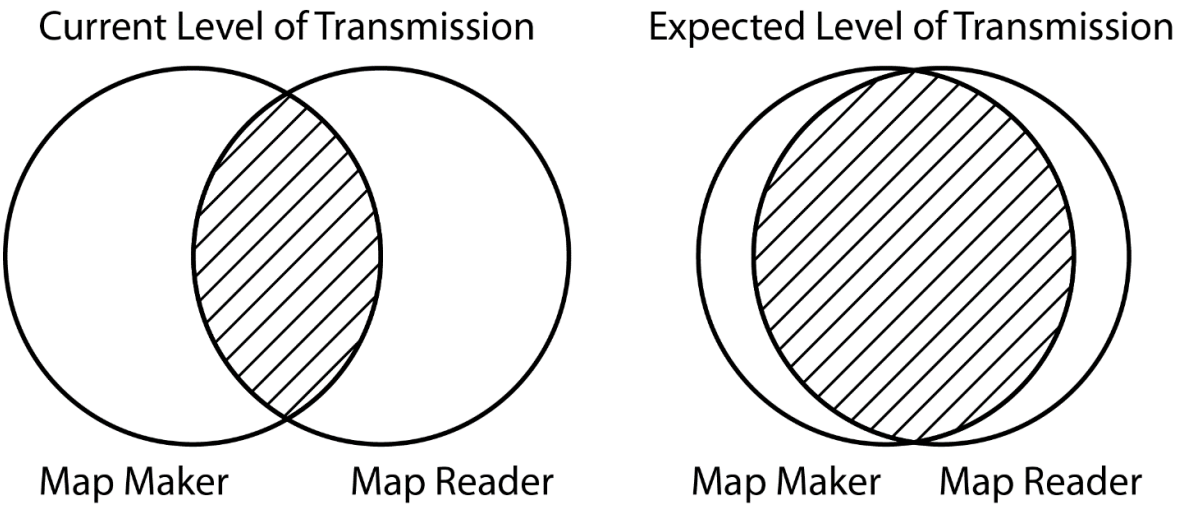

Figure 1.3. Information sent by the map maker that is received by the map reader.

The primary objectives of this study include:

1. Determining an effective system for the understanding and organization of Russian military map symbology and terms. Specific objectives included:

a) Collecting existing data on approximately 1,000 map symbols and 3,000 Russian terms;

b) Translating and determining associated meanings of Russian military map symbology and terms.

c) Developing an interdisciplinary, semiotic-based methodology for the understanding and organization of Russian military map symbology and terms.

2. Developing a database capable of storing Russian military map symbology and terms structured by a semiotic-based methodology. Specific objectives included:

a) Determining an appropriate entity–relationship model consisting of entities for symbols, terms and associated acronyms, and one for each typology and taxonomy.

b) Establishing measures of effectiveness to determine how Russian military map symbology and terms in a semiotic-based organizational system compared to the system used to organize US military map symbology and terms.

Overview of Research

Communication and Understanding

This study proposes that the understanding and organization of Russian military map symbology and terms can best be accomplished through semiotics, the study of the triadic relationship between the map, the user, and reality. A semiotic approach is best for understanding, due to how the map symbols and their accompanying terms are viewed. Typically, the map symbols and the accompanying terms are viewed as two completely different objects. But a semiotic perspective compels the map symbols and terms to be viewed as a single symbol, and that the parts of that symbol are mutually constitutive. Another reason that a semiotic approach is beneficial is how translations were conducted for the study. In most cases, a literal (traditional) way of translation was acceptable, but a semiotic approach proved beneficial in a few cases where the literal translation would cause the reader to gain a different understanding of the term than what the symbol author intended. These cases usually involve military slang — when military and civilian definitions of the same term differ, and particularly when the Russian and English cognates have different definitions. For instance, the Russian military term '*divizion'* is often translated as 'division' in English, in Russian the term means 'battalion', with an artillery connotation. A major finding of this study was that attempting to translate Russian military

map symbology and terms by the exact 'dictionary' definitions result in a distortion of understanding of the represented phenomena. A semiotic understanding of Russian military map symbology and terms requires not only *translations* of the terms, but also *definitions* of the terms. And by extension, another major finding of this study is that there can be no one-to-one translation of Russian military map symbology and terms into Western (US/NATO) or any other system of map symbology and terms.

The study recognizes two (independent) founders of semiotics/semiology, Charles Sanders Peirce and Ferdinand de Saussure. Although elements of both founders are used, this study primarily relies upon the semiotic theories of Charles Sanders Peirce, which has three main components: interpretants, objects, and signs. Peirce had many different views on these components over the years, but the following statement, in Peirce's own words, gives a succinct description of his theory. "I define a sign as anything which is so determined by something else, called its Object, and so determines an effect upon a person, which effect I call its interpretant, that the latter is thereby mediately determined by the former" (Peirce, 1998, p. 478).

In Peirce's semiotics, there are three forms a sign (signifier) can take. An <u>icon</u> physically resembles the signified, the object being represented (for instance, a driver's license photo representing the driver). An <u>index</u> describes the relationship between signifier and signified. An icon cannot exist without the presence of the signified (for instance, smoke indicates fire). A <u>symbol</u> has no physical resemblance to the signified (object). The relationship between signifier and signified is learned. An important implication of the theory is the interpretant is itself a sign in the mind of the interpreter.

This means that the way a signifier of a signified object is interpreted can vary by the interpreter. For the same meaning to be conveyed between two individuals, a common set of norms must be shared. This study has bridged the intent of the Russian map-maker to the understanding of the Western map reader.

Categorization

This study is premised on the belief that data categorization is not simply done to facilitate the sorting and search of data, but also done to assist in making sense of a complex world and recognizes that although there is no one 'correct' way to categorize data, there should be some effort to categorize the qualitative data collected for this study in the best manner possible. Since this study is based upon a semiotic methodology and firmly grounded in European structuralism, it has leveraged some of the great semiotic and structuralist thinkers to achieve this end. Ontologically speaking, these thinkers generally believe that representation (abstraction) and represented (abstracted) are very different things, and the best representations are 'structurally similar' to the phenomena that they represent. Perhaps Alfred Korzybski summed up this sentiment best when he stated that "A map is not the territory it represents, but, if correct, it has a similar structure to the territory, which accounts for its usefulness" (Korzybski, 1994, p. 58). Concerning categorization, this means the system of categorization (abstraction) should parallel the phenomena (abstracted) being categorized, and in relation to this study, in particular, this means that the categorization system should be modeled upon the military that it represents.

Although this study is premised upon semiotics and structuralism to achieve a semiotic approach to categorization, this study's methodology has incorporated some elements from the disciplines of psychology and sociology. This includes the use of Rosch's (1978) principles of 'cognitive economy' and 'perceived world structure' to categorize Russian military map symbology and terms so they have the same relations and multidimensional order as the phenomena they represent. Despite different academic traditions and varying terminologies, this study found much common ground among the works consulted.

The categorizations themselves can be described as being taxonomies or typologies, depending on the theme of the attribute of the phenomena being categorized. Although definitions vary, this study has employed Bailey's (1994) definitions of the terms. Taxonomies are primarily used in the natural sciences, are used to describe physical or empirical characteristics, while typologies are primarily used in the social sciences, to describe the categorization of concepts. With these definitions in mind, this study used taxonomies to classify the appearance of the symbols and their hierarchical relationships, and typologies to describe the more subjective attributes. After categorizing these symbols and terms by both Russian and US/NATO military methods, a major finding of this study is that attempting to categorize Russian military map symbology and terms by Western (US/NATO) categories results in a distortion of understanding of the relationships of the represented phenomena.

Data Storage and Retrieval

The storing/retrieval of the signs (map symbols) can be accomplished by a relational database. A relational database can store the alphanumeric, imagery, and metadata required to store the signs (map symbols). It also has many advantages. A relational database can support many class/sorting categories (store many typologies and taxonomies), easily integrates with other applications, enforces referential integrity, and improves data sharing. Although a relational database storing this information, since we are also dealing with interpretive aspects, a substantial textual narrative will need to accompany the database to explain some broader concepts.

Significance of the Study

This study proposes a methodology for the understanding, organizing, and storing of Russian military map symbology and terms, furthering the research and understanding of the Russian military. From a governmental perspective, a more complete understanding of Russian military maps will allow foreign governments to better understand the 'Russian view' of military matters. This is particularly helpful at a time when Russian and Western relations are at historic lows, where a misinterpreted threat could lead to military conflict. This study will not only assist in understanding Russian military mapping but could also assist in understanding military mapping in other countries. This is because the Russian military system and maps prevail in many parts of the world (particularly Africa, Latin America, and Southeast Asia) due to Soviet/Russian security assistance activities. In this context, this study could be particularly useful for not only understanding typical military activities, but also useful for humanitarian activities, such as mine clearing.

In terms of benefits for academia, this study facilitates historical research by allowing researchers (particularly, military historians) a more complete understanding of Russian military maps. This enhanced understanding may allow researchers to query sources that would otherwise be incomprehensible, or allow increased or new understanding from previously exploited maps. Perhaps the greatest academic benefit of this study is that the developed methodology could be applied to the understanding, organizing, and storing of other systems of map symbology and terms.

Russian military map symbology and terms are derived from a long tradition of Russian cartography, from its beginnings, this tradition has been entwined with the interests of the State. Russia's modern cartographic tradition can be traced directly to Peter the Great, who imported Western science, technology, and experts to create cartographic institutions renowned for excellence, whose successors can still be found in Russia to this day. Russia's system of Russian military map symbology and terms was likely developed in the interwar period to supplement this cartographic tradition and accommodate the rapid military technological advances of the time. This system of military map symbology and terms is essentially the same today, as it was when initially fielded, except for the addition of new symbols and terms for new technologies as they arise.

This study proposes that the understanding and organization of Russian military map symbology and terms can best be accomplished through semiotics, the study of the triadic relationship between map, user, and reality. And posits a three-pronged methodology for the understanding, organizing, and storing of Russian military map

symbology and terms. The following chapter consists of a literature review that provides a semiotic-based theoretical foundation for the understanding of Russian map symbology and terms.

CHAPTER 2

LITERATURE REVIEW

"A map is *not* the territory it represents, but, if correct, it has a *similar structure* to the territory, which accounts for its usefulness."

— Alfred Korzybski, *Science and Sanity*, 1994

The central research question of this study is, how can a system of map symbology and terms be organized? Korzybski, the founder of General Semantics, himself a former Army officer in the Russian empire, provides some insight on the ontological nature of this question. (Rapoport, 1950, p. 163).[4] Korzybski is best known as being the founder of General Semantics and has been closely linked to semiotics and structuralism (Read, 1983, p. 18). He also popularized Eric Temple Bell's idea that 'The map is not the thing mapped', as he gave several 'rules' governing the nature of maps.

> A) A map may have a structure similar or dissimilar to the structure of the territory.
> B) Two similar structures have similar 'logical' characteristics. Thus, if in a correct map, Dresden is given as between Paris and Warsaw, a similar relation is found in the actual territory.
> C) A map is not the territory.
> D) An ideal map would contain the map of the map, the map of the map of the map., endlessly. This characteristic was first discovered by Royce. We may call it self-reflexiveness. (Korzybski, 1994, pp. 750-751)

Korzybski used the metaphor of a map to explain his theories, as the metaphor of a map can be used to explain other abstractions of reality (theories, models, symbols, language, etc.). Maps, and by extension other abstractions of reality, are inherently

[4] Alfred Korzybski was born in 1879, to an aristocratic Polish family in Warsaw, Poland which at the time was part of the Russian Empire. He was trained as an engineer at the Polytechnic Institute of Warsaw, and then served in the Russian cavalry, artillery, and later in the Intelligence Directorate of the Russian General Staff.

imperfect, as their purpose is to take complex phenomena and put them at a scale which we can more readily comprehend. According to Korzybski, we are so reliant on these abstractions of reality when navigating our daily lives, that we are often unaware of their existence, and when these abstractions are incorrect, situational understanding is impossible (Parrish, 2015). If abstractions are imperfect, what do 'correct' abstractions look life? Korzybski proffers an answer, they have a similar structure, defined in terms of relations and multidimensional order, as the phenomena they represent (Korzybski, 1994, p. 751). As will be discussed, semiotics provides a methodology to understand these relations and multidimensional order.

What is Semiotics?

Semiotics, and their many permutations and derivatives, can most simply be described as the study of signs, meaning communication and understanding. In particular, semiotics studies how linguistic and non-linguistic sign systems impart meaning. There has been a substantial debate whether this study of signs is most aptly termed a 'point of view', 'science', 'discipline', or 'doctrine', an issue that will be explained in greater detail in the following chapter (Sless, 1986, p. 5). But what is certain is that semiotics has been around at least since the early Greeks, as the term 'semiotics' is derived from the Greek word, *sēmeiô*, "to mark." Although the study of signs has been a field of study since ancient times, in current usage, the term 'semiotics' is most closely associated with two pioneering theorists Charles Sanders Peirce (1839-1914) and Ferdinand de Saussure (1857-1913), who were contemporaries, but theories appear to have developed independently. Although the study of semiotics is vast, most in the field would agree that: "semiotic is the

study of signs or an epistemology about the existence or the actuality of sign in societal life" (Yakin, Mohd, & Totu, 2014, p. 5). Yakin, Mohd, and Totu use this definition as the jumping-off point between the major schools of semiotic thought spawned by Pierce and Saussure.

Ferdinand de Saussure- sign as signifier and signified

Ferdinand de Saussure is considered the father of modern linguistics and the European school of semiotic thought, coining the term 'semiology' as his term for semiotics. [Although the terms 'semiotics' and 'semiology' are often used interchangeably, the term 'semiology' is usually associated specifically with Saussure.] Saussure believed that semiology is a study of the laws governing signs. Saussure's take on semiology was that linguistics is only a part of the science of semiology, but that language (linguistic signs) is the most important sign system (Chandler, 2007, p. 8).

> A science that studies the life of signs within society is conceivable; it would be a part of social psychology and consequently of general psychology; I shall call it semiology (from Greek sēmeîon 'sign'). Semiology would show what constitutes signs, what laws govern them. Since the science does not yet exist, no one can say what it would be; but it has a right to existence, a place staked out in advance. Linguistics is only a part of the general science of semiology; the laws discovered by semiology will be applicable to linguistics, and the latter will circumscribe a well-defined area within the mass of anthropological facts... To determine the exact place of semiology is the task of the psychologist! (Saussure, 2011, p. 16)

Saussure distinguished between *langue* (language) and *parole* (speech). In this view, *langue* refers to a universal structure of language (grammar and vocabulary), while *parole* refers to particular instances of parole (speech) when langue is used. What matters most in this approach is certainly the underlying system (*langue*) and not specific instances

(*parole*). In practice, Saussure implemented his theory through a dyadic system with two components, the marker-sound image (signifier) and the concept (signified), as shown in Figure 2.1. (Yakin, Mohd, & Totu, 2014, p. 6).

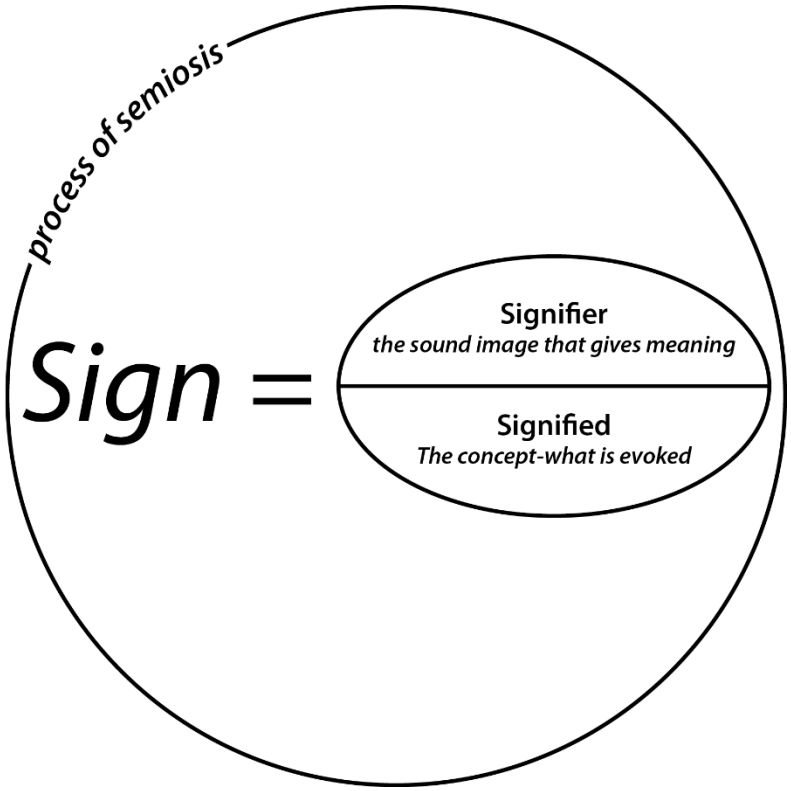

Figure 2.1. Saussure's dyadic-system of semiotics

Saussure argued that the meaning of signs is arbitrary because different languages use different words (signifier) to refer to the same concepts (signified). Thus, signifiers acquire their meaning from their inherited structure and relationship to other signifiers.

> The linguistic sign, as defined, has two primordial characteristics. In enunciating them I am also positing the basic principles of any study of this type.
> *Principle I: The Arbitrary Nature of the Sign*

> The bond between the signifier and the signified is arbitrary. Since I mean by sign the whole that results from the associating of the signifier with the signified, I can simply say: the linguistic sign is arbitrary…
> *Principle II: The Linear Nature of the Signifier*
> The signifier, being auditory, is unfolded solely in time from which it gets the following characteristics: (a) it represents a span, and (b) the span is measurable in a single dimension; it is a line. (Saussure, 2011, pp. 28-29)

This epistemology is grounded on the belief that that language does not reflect reality, but also has a role in constructing it (Chandler, 2007, p. 6). Most scholars strongly associate Saussure and this way of thinking with the concept of structuralism (Salupere, 2011, pp. 272-275). Criticism of Saussure often derives from his approach that almost exclusively looks at the system (structure) instead of specific instances. According to Chandler, "A fundamental objection is that the prioritization of structure over usage fails to account for changes in structure." Perhaps one of Saussure's closest admirers, but strongest critics, the Marxist linguist Valentin Voloshinov, illustrates how Saussure's methodology of signs can be adopted, but without the strict splitting of the subject from the structure.

> Every sign, as we know, is a construct between socially organized persons in, the process of their interaction. Therefore, *the forms of signs are conditioned above all by the social organization of the participants involved and also by the immediate conditions of their interaction*. When these forms change, so does sign. And it should be one of the tasks of the study of ideologies to trace this social life of the verbal sign. Only so approached can the *problem of the relationship between sign and existence* find its concrete expression; only then will the process of the causal shaping of the sign by existence stand out as a process of genuine existence-to-sign transit, of genuine dialectical refraction of existence in the sign. (Voloshinov, 1973, p. 21)

Clearly, Voloshinov saw value in the sign/signifier relationship. Where Saussure goes astray (in Voloshinov's view) is his inability to see the mutually constitutive nature of sign and signifier. This is a belief that Voloshinov has likely inherited from Marxism's

grounding in dialectical materialism. Other criticisms of Saussure, or more broadly stated the structuralism that Saussure's semiotic is associated, have come from the so-called 'post-structuralists', a term that is somewhat divisive as many critiques of structuralism do not identify with. This post-structuralism movement emerged out of 1960s France as a critique of structuralism and has been used to describe the work of noted critical theorists such as Michel Foucault, Roland Barthes, Jacques Derrida, and Jürgen Habermas (Harrison, 2006, p. 122). The post-structuralists offer a variety of criticisms of structuralism, but generally, their arguments are quite similar to Voloshinov, as they argue both the instance itself and the system of knowledge must be studied.

Aside from Voloshinov, other Soviets were also taking a keen interest in the nexus of Saussure, semiotics, and structuralism. Noted semioticians such as Yuri Lotman, Boris Uspensky, Vyacheslav Vsevolodovich Ivanov, Vladimir Toporov, Mikhail Gasparov, and Alexander Piatigorsky founded and/or became members of the Tartu–Moscow Semiotic School (TMS). (The definition of 'school' in this context is a term used by others to describe members of a group perceived from the outside the mainstream, that they themselves may not claim to be.) The TMS absorbed the already well-entrenched school of Moscow linguistics and Russian Formalism, the forerunner of modern literary criticism. The focus on literary criticism in the TMS would have a significant impact on the TMS brand of semiotics. In Saussure's theory, langue (language) determines parole (speech), but in the TMS school primacy shifts to the text. In this context, the term 'text' includes: art, literature, ritual, and everyday behavior. More simply stated, instead of studying singular signs, the TMS took a more holistic approach by studying text-based signs with

more complex 'clusters of meaning' (Grishakova & Salupere, 2015, pp. 174-183). A consequence of this difference is that while Saussure's semiotic theory is grounded in psychology, the TMS's broader, more holistic approach, causes it to be inherently interdisciplinary in nature.

Although the TMS, and its most prominent semiotician, Yuri Lotman are strongly associated with Saussure, semiotics, and structuralism, some scholars have pointed out that some of Yuri Lotman's later work, and perhaps by extension the TMS, begin to take a more post-structural approach to semiotics (Schönle, 2006, p. 7). In Lotman's *Universe of the Mind* and *Culture and Explosion,* a post-structural position can be seen in his concept of 'semiosphere' (Nöth, 2013, p. 17). Despite Yuri Lotman passing away in 1993, the TMS tradition of semiotics is alive and well to this day and can be found in The Department of Semiotics at the University of Tartu.

Charles Sanders Peirce- sign as signifier, signified, and object

Charles Sanders Peirce was a polymath with accomplishments in the fields of philosophy, metaphysics, epistemology, mathematics, chemistry, astronomy, science, logic, religion, psychology, criminology, ancient history, the history of science, and particularly logic. He was also an experimental psychologist, dramatist, actor, economist, and geographer. He is considered the father of the philosophy of pragmatism and the American school of semiotic thought and coined the term 'semiotics' (Brent, 1998, pp. xviii-3). Perhaps the most succinct description of Peirce's achievements was written by the British Nobel laureate, Bertrand Russell, "that beyond doubt that he [Charles Sanders

Peirce] was one of the most original minds of the later nineteenth century and certainly the greatest American thinker ever" (Russell, 1989, p. 276).

While Saussure grounded his theory of semiotics in psychology, Peirce's semiotics has a more expansive view grounded in his philosophy of pragmatism and particularly logic. For Peirce, semiotics had applications across many disciplines, as Liszka describes.

> As noted, Peirce sees semeiotic as supplying leading principles to sciences such as general and social psychology and linguistics; it also serves to establish criteria by which such investigations can derive good results from the employment of signs and shows, in general, the formal character of signs as such. So one might say that for Peirce the relation between linguistics and semeiotic is one of discipline to methodology, or empirical science to formal science, whereas for Saussure the relation is one of general to particular discipline. Peirce certainly believes this to be true of the relation between psychology and linguistics, but not between semeiotic and linguistics. (Liszka, 1996, p. 56)

Aside from broader philosophical differences between Saussure and Peirce, there are also significant differences in their understanding of sign systems. While Saussure proposed a dyadic relationship between signifier and signified, Peirce proposed a triadic relationship between representamen (signifier), signified (interpretant), and object (referent). Terms which he frequently relabeled and redefined throughout his extensive writings.

> …by "semiosis" I mean…an action, or influence, which is, or involves, a cooperation of three subjects, such as a sign [signifier/representamen], its object [referent], and its interpretant [signified], this tri-relative influence not being in any way resolvable into actions between pairs. (Peirce, 1998, p. 411)

In Peirce's methodology, the referent refers to the object that the sign represents and the representamen refers to the signifier, or in other words symbol, that it represents. (For instance, a cat (object or referent) can be symbolized by the word 'cat' that is a

referent to the object.) In this aspect, Saussure and Peirce's theories are quite similar, but where Peirce diverges is his inclusion of the third aspect of sign, the interpretant. The interpretant can be thought of as the effect on the one comprehending the representamen/object relationship. Liszka (1996) believed that Peirce took this one step farther: "every sign must be capable of determining an interpretant. The interpretant can be understood in its most generous sense as the translation of a sign" (p. 24). An important feature of this concept is the understanding that the interpretant (signified) is created in the mind of the observer, so the referent (object) is not a given in semiotic theory but is instead inferred by the observer. This means that a single representamen (signifier) can have multiple interpretants, and hence multiple meanings, dependent upon context.

The semiotic traditions of Saussure and Peirce are both grounded in the belief that that language, and hence mapping, do not just reflect reality, but also has a role in our understanding of it. But for this study of Russian military mapping, the Peircean triadic-model appears to be a better fit than the Saussurean dyadic-model. This is because Saussure's semiotic model is focused on linguistics, as it views linguistics as a branch of semiotics which is in turn a branch of psychology. [A notable exception in the Saussurean tradition is the Tartu–Moscow Semiotic School.] While the Saussurean model is optimized for the description of linguistic phenomena, Peirce's triadic model was designed for much broader applications. Peirce's view is that semiotics can be used in the analysis of any natural or social science, including linguistics, and is often considered an interdisciplinary approach to analysis as it often crosses disciplinary lines, as opposed to Saussure's model which is grounded in psychology. Peirce's triadic model, which differentiates signifier

(representamen), signified (interpretant), and object (referent), as shown in Figure 2.2, is more useful than Saussure's dyadic langue and parole model for this study's objectives. (Since this research focuses on graphic symbols and written words and acronyms, the more encompassing approach of Peirce would be more beneficial.) Peirce also has a sophisticated system describing each of the three components of his triadic-system, and a well-described process of 'semiosis' or description of how things gain meaning, that well facilitates analysis, which is explained in greater detail in the following chapter.

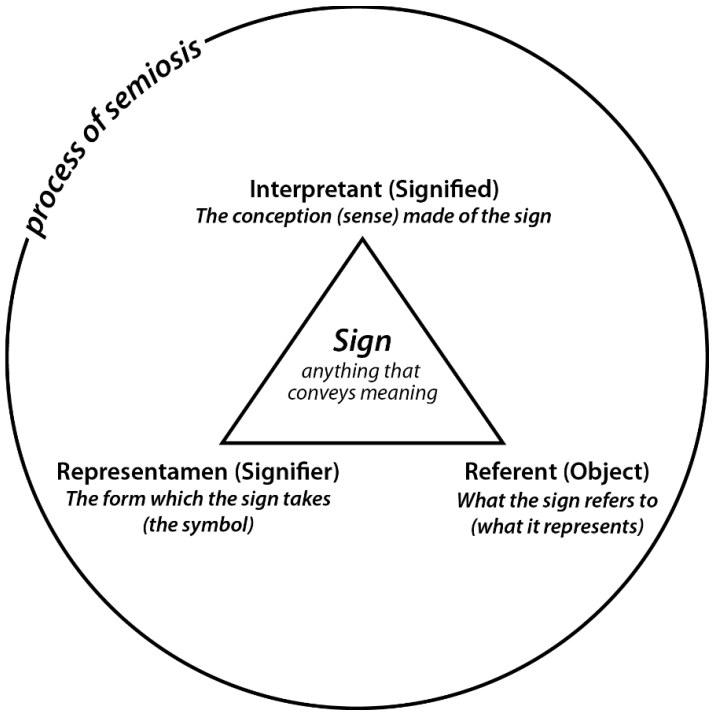

Figure 2.2. Peirce's triadic-system of semiotics

Classifications of Peirce's Triadic System

Interpretant- Peirce developed a three-tiered classification system for interpretants/signified. The immediate interpretant, or felt or naïve interpretant, can be

thought of as the "total unanalyzed effect" that the sign produces. The dynamic interpretant, or middle interpretant, can be thought of as the effect that the sign has upon the interpreter. The final interpretant, or eventual, normal, or ultimate interpretant, is any rule or law like the effect the sign has on the interpreter. Or as Peirce states: "the ultimate effect of the sign, so far as it is intended or destined, from the character of the sign, being more or less of a habitual and formal nature" (Liszka, 1996, pp. 25-27).

Representamen- Peirce's concept of representamen/signifier involved three forms that it could take. A symbol has no physical resemblance to the signified (object). An icon physically resembles the signified or the object being represented (for instance, a driver's license photo representing the driver). An icon cannot exist without the presence of the signified (for instance, smoke indicates fire). An index describes the relationship between signifier and signified as Chandler describes these aspects.

> 1. **Symbol/symbolic**: a mode in which the signifier does *not* resemble the signified but which is fundamentally *arbitrary* or purely *conventional* – so that this relationship must be agreed upon and learned: e.g. language in general (plus specific languages, alphabetical letters, punctuation marks, words, phrases and sentences), numbers, morse code, traffic lights, national flags.
> 2. **Icon/iconic**: a mode in which the signifier is perceived as *resembling* or imitating the signified (recognizably looking, sounding, feeling, tasting or smelling like it) – being similar in possessing some of its qualities: e.g. a portrait, a cartoon, a scale-model, onomatopoeia, metaphors, realistic sounds in 'programme music', sound effects in radio drama, a dubbed film soundtrack, imitative gestures.
> 3. **Index/indexical**: a mode in which the signifier is *not arbitrary* but is *directly connected* in some way (physically or causally) to the signified (regardless of intention) – this link can be observed or inferred: e.g. 'natural signs' (smoke, thunder, footprints, echoes, non-synthetic odours and flavours), medical symptoms (pain, a rash, pulse-rate), measuring instruments (weathercock, thermometer, clock, spirit-level), 'signals' (a knock on a door, a phone ringing), pointers (a pointing 'index' finger, a directional signpost), recordings (a photograph, a film, video or television

> shot, an audiorecorded voice), personal 'trademarks' (handwriting, catchphrases). (Chandler, 2007, pp. 36-37)

The relationship between signifier and signified is learned. An important implication of the theory is the interpretant is itself a sign in the mind of the interpreter. This means that the way a signifier of a signified object is interpreted can vary by the interpreter, and implies that for the same meaning to be conveyed between two individuals, a common set of norms must be shared (Liszka, 1996, pp. 37-38). The process of the interaction between the representamen, interpretant, and object is what Peirce refers to as semiosis, or semeiosis (Chandler, 2007, p. 30).

Referent- Peirce's semiosis lead to a concept that the object/referent has different states as it is interpreted. The immediate object is the object as first perceived and interpreted, and as it is interpreted as it continues through a cyclical process until it is fully understood as possible. The dynamic object is the object as it becomes fully understood. As Liszka describes: "The dynamic object of the sign is the invisible hand which, in the long run, guides the semeiotic process to a final determination concerning any information or signification concerning that object even if that means the interpretation of the sign fails to generate any positive information" (Liszka, 1996, p. 21).

Peirce and Cartography

Charles Sanders Peirce was a polymath with accomplishments in many fields, but even though he is most famous for his work as a semiotician and philosopher, Peirce by far spent the most time, and made his living, essentially as a geographer. Peirce worked for United States Coast and Geodetic Survey from 1861-1891, serving as a geodesist, cartographer, and surveyor (Brent, 1998, p. 3). In the course of his work for the Survey, Peirce participated in five scientific expeditions to Europe and became the first formal US representative at an international conference when he attended the International Geodetic Association in Stuttgart, Germany. Peirce gained great respect from the leading Europeans in the field when he demonstrated that the flexure of pendulum stands was introducing errors into European gravimetric measurements (Brent, 1998, p. 106). Peirce's work with geodesy and gravimetrics was so well regarded, that he was even considered an expert by European geodesists (Maher, 1993, pp. 1-2).

In furtherance of his geodesy work at the Survey, Peirce developed his own map projection in 1879, the Peirce quincuncial projection, as shown in Figure 2.3. This projection is often configured to depict the four quadrants of the globe around the center hemisphere in a square pattern, with the North Pole in the center of the map, with the equator appearing to be a square. Peirce designed this conformal projection to 'show the connection of all parts of the surface' (Peirce, 1879, pp. 394-396). Although the projection appears somewhat peculiar and is seldom used, its properties make it particularly suitable for astronomical viewing purposes (Taylor & Bell, 2013, pp. 5.13-5.15).

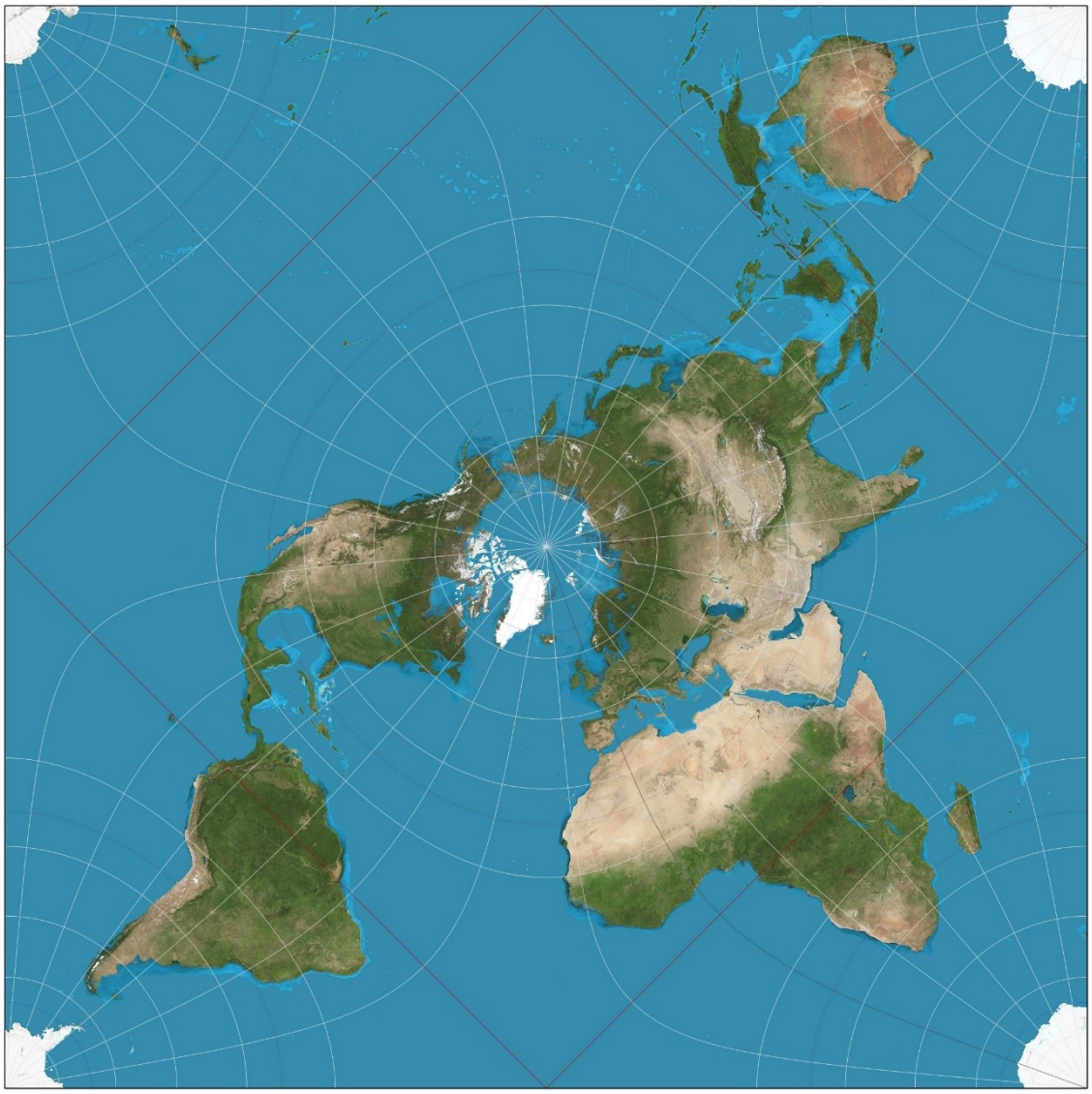

Figure 2.3. Peirce's quincuncial projection. From "Peirce quincuncial projection," by D. R. Strebe, 2012, CC BY-SA 3.0.

Despite Peirce's long employment at United States Coast and Geodetic Survey and significant geographic achievements, there is very little direct connection in his writings linking this aspect of his life, with his other great life pursuit — semiotics. Daniel H. Maher posits a few reasons why Peirce never made this seemingly sensible connection.

The first is the view of cartography during Peirce's lifetime. Today, cartography is seen as a subdiscipline of geography, and there is an important subset of cartography that focuses upon the understanding of map elements. In Peirce's day, cartography was not seen as an academic pursuit and was instead seen as more of a vocation in support of the military, government, and commerce. Since Peirce's work with the United States Coast and Geodetic Survey was primarily fieldwork concerning the very technical sciences of surveying and geodesy, and less so in the more subjective field of cartography, most of his Survey work was ill-suited to semiotic analysis. But even if Peirce had focused upon cartography, the cartography of his day was seen much more as a science than the cartography of today which is seen more of a combination of art and science. Perhaps an even more important reason that Peirce did not bridge geography, and cartography in particular, to semiotics is Peirce's personal view towards his work at the Survey, and geography in general. Peirce never envisioned that he would work for the Survey for an extended period, and saw the Survey as simply a stepping stone and means of financial support until he could accomplish his true goal of attaining an academic professorship. Not only did Peirce not relish his career with the Survey, but when stating his profession or occupation while employed at the Survey, he usually chose to refer to himself as a chemist, rather than a surveyor, geodesist, or cartographer (Maher, 1993, pp. 56-57). Charles Sanders Peirce may have founded semiotics, and was a talented geographer, but he never linked these two disparate fields, and so a bridge between semiotics and cartography must be looked for in successive generations of semioticians.

Semiotics and Cartography

Perhaps the father of semiotic-influenced cartography is the French Cartographer Jacques Bertin. Bertin was the founder of the Cartographic Laboratory of the École pratique des hautes etudes (EPHE), director of the Graphics Laboratory of the École des hautes études en sciences sociales (EHESS), and he eventually became a researcher at the National Centre for Scientific Research (CNRS). Bertin is best known for his seminal work, *Semiologie Graphique* (*Semiology of Graphics*). *Semiology of Graphics* has been reprinted in several languages and is acknowledged for being one of the first serious studies of cartographic visualization. Although published in 1967, well before the advent of desktop-computer geographical information systems, many of the rules and features found in Bertin's work can be seen in modern GIS systems today. This includes planar data displayed by X, Y, and Z attribute; six visual variables (size, value, texture, color, orientation, and shape); three meanings (quantitative, ordinal, and differential) and three types of sign (point, line, and zone). According to Morita (2011), although many of these features had been used previously by other cartographers, they had never been developed into a singular sign system (pp. 87-88).

> Graphics owes its special significance to its double function as a storage mechanism and a research instrument. A rational and efficient tool when the properties of visual perception are competently utilized, graphics is one of the major 'languages' applicable to information processing." (Bertin, 1983, p. 2)

Similarly, Morita (2011) acclaimed, "Bertin conceived the sign system as a form of operational graphics to discover the hidden structure of the phenomena derived from the articulation of visual patterns" (p. 90). Therefore, symbols can not only assist in

describing the referred object but can also assist in understanding the structure in which the object occurs. Interestingly, Bertin does mention the practical qualities of Peirce's quincuncial projection, which he refers to as a 'periodic projection' in *Semiologie Graphique*, but makes no mention of Peirce's semiotics (Bertin, 1983, pp. 288, 292). Rød points out some ambiguity whether Bertin identified with the Saussurean tradition of semiotics. Although Bertin uses Saussure's terms "semiology" and "signifieds", Bertin never cited Saussure or other structural linguistics that use these terms. Bertin rejected Saussure's first principle, the arbitrary nature of the sign, but did use the second principle that differentiates between auditory and visual signifiers (Rød, 2006, p. 29). It has been found that despite some significant differences in thought, Bertin's concept has much in common with Saussure (Rød, 2006).

Aside from Bertin, perhaps the most preeminent name associated with semiotics and cartography is Hansgeorg Schlichtmann (1938-2020). Dr. Schlichtmann is known for his work with cultural geography, historical geography, and cartography/cartosemiotics, and is associated with Saussurean semiotics (Schlichtmann, n.d.). Schlichtmann is particularly intersected in cartosemiotics, also referred to as cartographic semiotics or map semiotics, and defines this term in his 2011 work *Cartosemiotics: A short dictionary*.

> **Cartosemiotics**
> Also *cartographic semiotics* or *map semiotics*
> (1) In a general sense, the semiotics, or the sign-theoretic study, of cartographic models – or cartographic representation forms --, the processes of their creation and use, and the contexts in which they originate and function.
> (2) In a narrower sense, all approaches to the study of cartographic representation forms which take their theoretical orientation from some school or schools of general semiotics… (Schlichtmann, 2011, p. 25)

In Schlichtmann's *Overview of the Semiotics of Maps*, he further explains his concept of cartosemiotics. Schlichtmann's concept has three components that are relevant this study of Russian military map symbology and terms. 1. Map symbolism (map language), or the type of sign systems that are found in maps. 2. Processes in which humans handle signs (or sign processes) 3. The context in which sign systems and sign processes are embedded (Schlichtmann, 2008). Although Schlichtmann was the most preeminent cartosemiotic scholar of recent years, perhaps Christina Ljungberg has provided the best explanation of the concept. According to Ljungberg, cartosemiotics as an applied science that is interdisciplinary in nature due its connections with both cartography and cognitive science.

> Maps are visual representations of territories. Like pictures, they can exist either on paper or similar material support or in people's minds as so-called mental maps. Cartosemiotics, the semiotics of maps, has therefore interdisciplinary connections with both cartography and cognitive science. Situated between the semiotics of pictures mental representation, and the semiotics of codes, cartosemiotics belongs to the general field of applied semiotics: Since maps usually contain written language and are signs encoded by certain cartographic conventions, they also need to be decoded. This combination of graphic and verbal elements makes them complex semiotic systems. Like pictures, maps represent surfaces and space through a two-dimensional medium. Since maps are two-dimensional media, they can represent space much better than words, which have to be pronounced in a linear sequence. At the same time, maps make use of an elaborate system of symbols to locate or describe geographical loci. Cartographic representations are usually provided with a legend to facilitate the interpretation of its signs. (Ljungberg, 2015)

The Czech linguist Bohumil Palek, took issue with Bertin's focus on only the individual symbols found on the map. Palek saw the entire map as a symbol requiring analysis, not just individual symbols and quotes, as renowned American Geographer,

Arthur H. Robinson wrote, “The entire map is a symbol, as well as its parts, and it is not quite correct to designate only certain components as symbols” (Robinson , 1953, p. 161).

> The obligatory consequence of Robinson's claim is the structural approach to map rules: map symbols ought to be observed as items the properties of which are in a certain way dependent on the properties of the other symbols. This does not mean that the structural approach exhausts the overall description of map symbols. In fact, such an approach does not take into account the pragmatic aspect of maps, namely the fact that each map conveys the intentions of its creator. (Palek, 1986, p. 14)

Palek viewed the cartography as a special form of communication that is a product of a two-dimensional semiotic system (Palek, 1986, p. 17) with maps consisting of two distinct languages.

> In cartography it is necessary to distinguish two languages:
> 1. G-language (geo-), containing G-concepts, which is used for the description of physical and abstract objects (i.e. for data which are the subject of mapping).
> 2. M-language (map-) containing M-concepts by means of which the symbols on the map are described.
> The aim of cartographic theory is also to explain the relationship between. (Palek, 1986, p. 21)

Palek appeared to be in the Peircean school of semiotic thought and is keenly interested the rules or laws of cartography, and the structure which underpins them.

While the other articles discussed in this review have all dealt with the theoretical aspects of semiotics and/or cartography, Donatas Ovodas, Algimantas Česnulevičius discuss the practical in *Semiotic Evaluation of Lithuanian Military Air Navigation Charts*. Ovodas and Česnulevičius were concerned with the symbology (sign systems) in Lithuanian military air navigation charts, primarily about how easily these symbols are understood by air crews. They describe their general methodology of their project in the following way.

> During semantic analysis, the aim was to determine how the conventional cartographical symbols, used in air navigation charts, correspond with carto-linguistic and carto-semiotic requirements. by:
> 1. The collection or semantics of the marking expressions.
> 2. Sign combination into groups or syntax." (Ovodas & Česnulevičius, 2014, p. 91)

Since this research is primarily concerned with sign taxonomy, the following factors were observed.

> 1. Sign description.
> 2. Sign form.
> 3. Sign similarity:
> – by shape,
> – by size,
> – by color (boundaries and area),
> – by group. (Ovodas & Česnulevičius, 2014, p. 91)

Following observation, this symbology was tested against a notional sign system with better cartosemiotic properties. Ovodas and Česnulevičius' research found that Lithuanian air navigation charts could be understood faster with smaller symbols by using a new sign system.

Cherry-Picking Saussure and Peirce

For this study, the most important difference between Saussure and Peirce's semiotics is the role of the signifier. In the Saussurean tradition, the signifier has content. In the Peircean school, due to the triadic relationship between signifier, signified, and object, the signifier has no content, because the signifier only acts as a surrogate in referring to the object. This means that a signifier only has meaning when it is perceived and induces an interpretation in its perceiver (Stolle, 1984, p. 423). This study will employ the Peircean model of semiotics because it attributes equal importance to the perceiver as it does the abstraction and abstracted. This is an especially important point for this study, as

the intent is to capture the meaning of Russian military map symbols and terms (signifiers) as they were intended by Russian map makers (signified) who have created them to best understand the military (objects) that they are representing.

Although this study is best suited for Peirce's triadic-system of understanding meaning, there are components of the Saussurean tradition of semiotics that have been incorporated. Most scholars strongly associate Saussure with the concept of European structuralism, and this concept can be seen in the work of many scholars in the Saussurean school. In terms of data visualization in general, and cartography in particular, none is better known than Jacques Bertin. Bertin had many achievements, but his theory that signs can not only assist in describing the referred object but can also assist in understanding the structure that the object occurs, is of significant value for this study. This theory means that any effort to understand Russian military map symbology and terms might not only lead to a system of organization that better helps us understand the cartographer's intent, but also helps understand the structure of the Russian military as a whole. Bertin's work is the foundation of Hansgeorg Schlichtmann's cartosemiotics, or maybe more simply stated as 'map language.' Aside from defining the term 'cartosemiotics', Schlichtmann has authored a dictionary of cartosemiotic terminology to further study in the field. Schlichtmann sees cartosemiotics as an interdisciplinary approach as it combines elements of psychology and cartography. The Czech linguist Bohumil Palek is in the Peircean School of semiotics, also likely an admirer of Bertin, but does find one aspect of Bertin to criticize. Palek disputes Bertin's focus on just the map symbology and not the map as a whole. Palek does this by distinguishing between a geographic language and the map

language. The value of Palek is this separation of these two languages. Although both are important, this study's focus is on the mapping language. Donatas Ovodas, Algimantas Česnulevičius's work is the only article that bridges semiotics to a military application. Of particular importance in their work is their methodology for the classification of military map symbols, a topic which will be explored in further detail in the following chapter.

Critical Cartography

Relevance of Critical Cartography

Although this research primarily employs a semiotic approach, there are some scholarly works outside of the semiotic tradition, primarily within the field of critical cartography, which is of value to this endeavor. Critical cartography is grounded in critical theory, so it aims to use the understanding of power relations to "interrogate the hidden agendas of cartography" (Harley, 1989, p. 3). In general, critical cartographers believe that cartographic representations "reflect and perpetuate relations of power, more often than not in the interests of dominant groups" (Firth, 2015, p. 9).

An aspect of critical cartography valuable for this study is the understanding of the relationship between cartographic representations and reality. Traditionally, cartographic representations were seen as being reflections of the phenomena that they represent, with cartography being the science and/or art of creating these representations. Bertin takes a more expansive view believing that cartographic representations could actually reveal new knowledge about the phenomena they represent. Critical cartographers go one step farther and believe that these sign systems can make reality as much as they describe it (Crampton & Krygier, 2010).

The idea that maps, and by extension map symbology and terms, shape reality may seem counterintuitive, but there are several practical examples. International borders have often been determined arbitrarily by drawing lines on maps with little regard for the physical or human geography, such as the 38th parallel which separates the Democratic People's Republic of Korea from the Republic of Korea. A more localized example is the effect of county zoning maps on communities, as these zoning maps (abstractions) drafted in city planner offices and city councils certainly impact the reality of the neighborhoods they govern. This concept of maps being able to shape reality is particularly relevant for military maps because military maps are often used for planning to depict where units, personnel, and equipment are intended to be. This means, that in a very real sense, the abstraction that the commander and staff depict on the map can become reality. For this, and several other reasons that will be mentioned, some discussion of critical cartography and a few other ideas outside of semiotics are warranted for this study. As will be seen, the use of semiotics by no means excludes the use of some aspects of critical cartography, as they share several common themes.

The Critical Cartographers

John Pickles, a prominent name in the critical cartography movement, proffers in *A History of Spaces: Cartographic Reason, Mapping and the Geo-Coded World*, "instead of focusing on how we can map the subject…focus on how mapping and the cartographic gaze have coded subjects and produced identities" (Pickles, 2004, p. 12). Pickles (2004) states that the purpose of his book is to "contribute to the emerging critical literature on the nature of maps…" by placing cartography within a "broad historical, social and political

context" (p. 19). Pickles (2004) introduced the concept of "critical mapping theory" – A theory that changed the way maps are viewed, no longer was mapping simply a science of "drawing and interpreting a line" (p. 1). Pickles (2004) believed that mapping/cartography needed a framework of "broad historical, social and political context" (p. 19), accomplished by taking an interdisciplinary approach to map-making/cartography that takes away some of the emphasis on technical/representational aspects of the topic. Pickles (2004) claimed his definition of mapping as "the transfer of information from one form of presentation into a re-presentation of that information" (p. 75).

Pickles (2004) distinguished between the technical term of "location" and the abstract idea of "place." In Pickles' view, map-making/cartography has historically only been concerned with the former, now there is growing emphasis on the latter. In the same way, there is a difference between location and place, there is a similar difference in the way these concepts are presented by way of cartography for "location" and mapping for "place." Pickles (2004) is primarily concerned with broadening the ways mapping is presented, as the contextual data of an interdisciplinary approach often requires more than simply "drawing and interpreting a line" (p. 1). For Pickles, mapping is very contextual; the representation can vary from mapper to mapper. "To ask what a map is and what it means to map, therefore is to ask: what world are you mapping, with what belief systems, by which rules, and for what purposes" (Pickles, 2004, pp. 76-77). Pickles broaches another major topic in his work, the relationship between mapping and society. In his view, most thought has focused on how societies have shaped mapping, Pickles asks the question, "how was it that social life and thought were affected by cartographic reason" (Pickles, 2004, p. 77). This

idea is a recurring theme in Pickles' work. The term "cartographic gaze" is Pickles' term to describe traditional geography/cartography's view of the world. Pickles believes this God's-eye view creates a false sense of objectivity for cartographers and geographers. Pickles pointed out this a result of what Donna Haraway called the "God-trick," because of the belief that one can never have a truly objective view of the world (Pickles, 2004, p. 80).

Pickles also argued that there can be no "single epistemology of sight" and "we might see mapping as a social practice with embodied social relations, rather than – as with most traditional histories – a discrete professional or technical activity" (Pickles, 2004, p. 87). These arguments help form the author's idea of "bricolage" (Pickles, 2004, p. 87). The term was borrowed from the old cartographic practice of merging all types of data into one product and then "smoothing out the differences" (Pickles, 2004, p. 89). Pickles used the term as a "metaphor for all mapping practices" that "poses a challenge to modernity and linear histories of development, progress or evolution in techniques of mapping and in the flux of representational styles" (Pickles, 2004, p. 89). Pickles' solution to "bricolage" was instead studying the "genealogical tracing of linkages and influences." (Pickles, 2004, p. 89).

Perhaps the most prominent critical cartographer is Denis Wood. As stated by Edney (2012), "Denis Wood has provided a consistent critique—both of the ideals of modern academic cartographers and modern cartographic ideology—since the late 1970s". In Wood's seminal work *Everything Sings*, he connects critical cartography to semiotics.

> Consult an atlas, find your fact (fast), reshelve the atlas. Do not read it, certainly do not read it cover to cover like a novel. What an amusing idea, reading an atlas, with its forbidding style of clipped sentences devoid of anecdotes, elaborations, and by-the-ways. As though anything were ever so

> simple. Yet this is one way maps maintain the illusion of their objectivity, their adherence to the factual. Admitting atlases were narrative – that they were *texts* – would force the admission that the individual maps were texts too, that maps constituted a semiological system indistinguishable from other semiological systems". (Wood, 2011, p. 9)

Fellow Travelers

Important to critical cartography is psychogeography, which is "the study of the precise laws and specific effects of the geographical environment, consciously organized or not, on the emotions and behavior of individuals" (Debord, 1955). Denis Wood described psychogeography as an extension of geosophy, "the study of geographical knowledge from any all points of view" (Wood, 2010, p. 192). [The discipline developed in Paris and Boston, independently, in the 1950s and 1960s.] In traditional cartography, the area of interest and the map maker are both considered to be two independent variables. The mapper simply annotates observations to make a map. Psychogeographers believe that mapper is a dependent variable. However, Lynch (1960) claimed, "the creation of the conventional image is a two-way process between the observer and observed" (p. 118)…"What he sees is based on exterior form, but how he interprets and organizes this, and how he directs his attention, in turn, affects what he sees" (p. 131). Since psychogeographers believed that geography, specifically urban geography, shaped the way we view and understand the world, their epistemology is much different regarding mapping. Psychogeographers believed that the interplay between geography and the mind was what needed to be studied. The "public image," (usually referred to simply as "image") produced from this process, or "the common mental pictures carried by large numbers of a city's inhabitants" was a better way of mapping (Lynch, 1960, p. 7).

Of interest in Debord's map in general, and Lynch's maps are their similarities to modern military mapping. Military mapping, like psychogeography, is primarily concerned with showing areas that allow, prohibit, and hinder movement. Another aspect that psychogeography shares with military mapping are some elements of common symbology. Debord and Lynch's use of arrows to annotate flows of movement and direction is very similar to the U.S Army's use of the term "avenue of approach," represented by arrows, to show movement.

> avenue of approach- An air or ground route of an attacking force of a given size leading to its objective or key terrain in its path (Department of the Army, 2018, pp. 1-8).

Debord's use of large red arrows for the annotation of movement is the same symbology that NATO and Soviet forces used to annotate the movement of Soviet Forces. Lynch's use of the term "decision point" throughout his work was an identical usage of the Army term "decision point."

> decision point (DP) (Army) - An event, an area, a line, or a point on the battlefield where tactical decisions are required resulting from the war-gaming process before the operation order. Decision points do not dictate commander's decisions, they only indicate that a decision is required, and they indicate when and where the decision should be made to have the maximum effect on friendly or enemy courses of action. (Department of the Army, 2018, pp. 1-25)

Lynch claimed this about decision points:

> Because decisions must be made at junctions, people heighten their attention at such places and perceive nearby elements with more than normal clarity. This tendency was confirmed so repeatedly that elements located at junctions may automatically be assumed to derive special prominence from their location. (Lynch, 1960, p. 73)

As will be described in chapter four, arrows are used similarly for Russian military symbology.

This literature review provides a semiotic-based theoretical foundation for the conceptualization of Russian map symbology and terms. The review begins with Korzybski's observation that representations, such as Russian map symbology and terms, are 'most correct' when they have a similar structure, defined in terms of relations and multidimensional order, as the phenomena they represent. Semiotics, rooted in structuralism, is proffered as a means to understand these relations and multidimensional order, particularly the semiotic theory of Charles Sanders Peirce's triadic-system of understanding meaning. This method gives equal importance to the perceiver as it does the abstraction and abstracted. This is an important point as the intent of this study was to capture the meaning of Russian military map symbols and terms as they were intended by Russian map makers who have created them in order to best understand the military that they are representing. Although this study relies on Peirce's triadic-system of semiotics, elements of the Saussurean semiotic tradition will also be leveraged. Since neither Peirce nor Saussure delved into how their theories could be applied for cartographic purposes, the work of subsequent scholars that have applied Peircean or Saussurean semiotics to cartography have been consulted.

Although this study is primarily focused on a semiotic approach to understanding and organizing Russian military map symbology and terms, there are some works outside of the semiotic tradition that are of value to it. Critical cartography is grounded in critical theory, proffering that maps reflect the views of those in power. In a sense, they believe

the map (as a sign system) has a role in creating reality, as much as describing it. Critical cartographers are not associated with semiotics or structuralism, yet they are reaching similar conclusions. In a similar vein, Pickles' "cartographic gaze," a term that critically describes traditional geography/cartography's singular view of the world, has a place in this research because of the premise that different signs/maps/symbols can be viewed differently by others. Although Lynch and Debord's work preceded critical cartography, they are still in tune with this premise. There work is particularly interesting because their descriptions of signs that allow, prohibit, and hinder movement, are not explored by other researchers, which is an exceptionally important part of Russian military mapping.

The following chapter develops a working methodology employing some of the findings in this literature. Although premised upon Peirce's general theory of semiotics, this study's methodology and terminology will be focus upon Charles W. Morris's development of Peirce's ideas, and draws some comparisons between semiotics and map communication theory. In addition, since there is an understanding that abstractions are 'most correct' when there is a 'similar structure' between abstract and abstracted, this study will combine the aforementioned theories, with some categorization and typological theories. And finally, there is a description of how this information collected, organized, and stored by means of a relational database.

CHAPTER 3

METHODS

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Semiotic has a double relation to the sciences: it is both a science among the sciences and an instrument of the sciences.

— Charles W. Morris, *Foundations of the Theory of Signs*, 1938

Semiotics can be considered as a science in its own right, and as an instrument of the natural and social sciences. In terms of the former meaning, the prominent semiotician Morris (1938) has described semiotic "as a science makes use of special signs to state facts about signs; it is a language to talk about signs" (p. 8) and as a "step in the unification of science, since it supplies the foundations for any special science of signs" (p. 2). To solve a real-world cartographic problem, this study has employed Morris's latter meaning, that of semiotics as a language of the natural and social sciences. (Since these sciences make use of, and are interpreted in terms of, signs.) Although semiotics has many different flavors, it can be described as an interdisciplinary method to attaining knowledge and problem solving, rooted in the social sciences. Gherlone (2013) provided the following description of the relationship between semiotics and interdisciplinarity as proffered by prominent semiotician, and one of the founders of the Tartu–Moscow Semiotic School, Yuri Lotman.

> For him, semiotic science offers itself as one of the possible antidotes contributing to interdisciplinary dialogue, proposing itself as a possible path towards a complex understanding of reality based on the multifaceted unification of perspectives…in other words, interdisciplinarity is the path through which it is possible to obtain a complex vision of reality. (Gherlone, 2013, pp. 392, 396)

The semiotic approach for this dissertation has required an interdisciplinary application of cartography, geographical information science, semantics, symbology, linguistics, and database design.

Communication and Understanding Methodology

Charles W. Morris

Charles Sanders Peirce was a prolific writer, his academic career spanned almost six decades, and there is an ongoing effort to create a 30-volume print edition of his published work and unpublished manuscripts. As accomplished as Peirce was in many fields, and despite the voluminous amount of his writings, Peirce struggled greatly with making his writing clear and easily understood. Peirce is known for coining many new words, with little in way of a detailed description, and then changing their definitions in subsequent writings. Also, his writing was often considered to be hard to follow, and was cited as one, of many, reasons that he had difficulty in acquiring an academic position (Brent, 1998, pp. 10-26). Perhaps Peirce best sums up his problems with the clarity of his writing in the following statement.

> One of the most extreme and most lamentable of my incapacities is my incapacity for linguistic expression ... I have suffered grievously from it since childhood; and I cannot tell you how assiduously I have labored to overcome it. I myself am conscious of the badness of my style, although I am probably not fully conscious of it. I can imagine one of my readers saying to another, "Why can he not express himself naturally?" I can supply the answer to that. It is because no linguistic expression is natural to him. He never thinks in words, but always in some kind of diagrams. He is always struggling with a foreign language; for every language is foreign…. (Peirce, 1909, pp. 7-8)

Although this study relied upon Peirce's Pragmatism, abductive reasoning, and the general theory of semiotics, this study has specifically leveraged the semiotic theory of Morris. As

will be described, Morris builds upon Peirce's theory of semiotics and manages to avoid Peirce's aforementioned idiosyncrasies.

Morris's semiotic theory is much the same as Peirce's theory, but Morris's triadic-system of semiotics has four components, as shown in Figure 3.1. The 'sign vehicle' (representamen/signifier) is the form that the sign takes. 2. The 'interpretant' (signified) is the effect of a sign on the comprehender. 3. The 'interpreter' is the comprehender or the agent of the process through which the sign vehicle functions as a sign. 4. The 'designatum' refers to a class of objects, while 'denotata' refers to specific members of the class (Morris, 1938, pp. 4-6). (For example, a designatum would refer to rivers in general, while a denotata would refer to a specific river.)

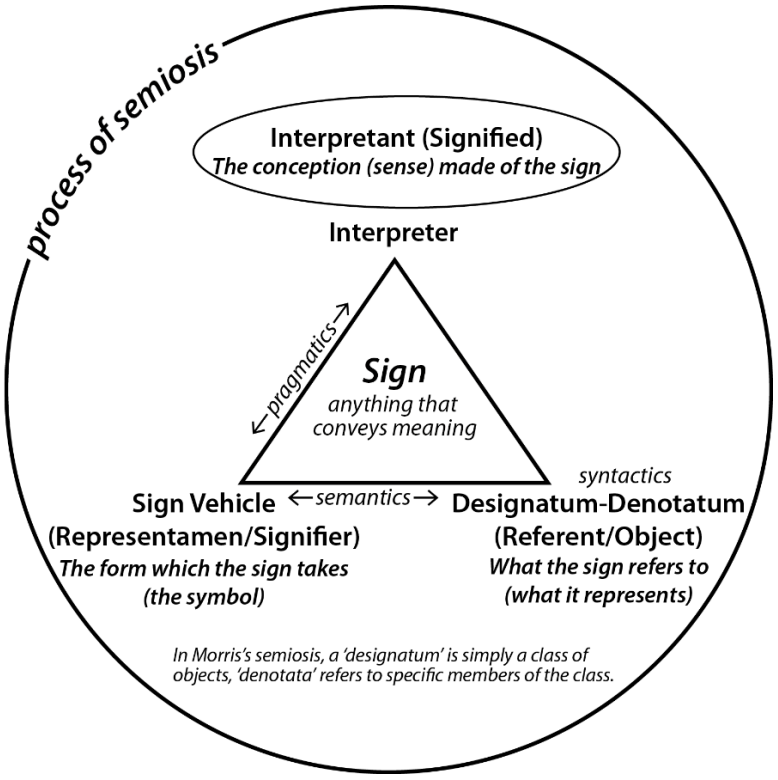


Figure 3.1. Morris's triadic-system of semiotics.

Morris further expands Peirce's theory by the addition of three 'rules' that govern the semiotic process, syntactics, semantics, and pragmatics. Syntactics is "the study of the syntactical relations of signs to one another in abstraction from the relations of signs to objects or to interpreters" (Morris, 1938, p. 13). Syntactic rules govern how signs are organized and how they may be combined to form compound signs. Specifically, syntactic rules pertain to issues such as which sign combinations are permissible, the proximity of one sign from another, and how signs can be constructed or derived from other signs. Syntactics is best exemplified by the grammar of any language (Morris, 1938, pp. 6-7). Semantics "governs the relation of signs to their designata [referents/objects] and so to the objects [denotata] which they may or do denote" (Morris, 1938, p. 21). These rules govern how designatum/denatum (referent/object) relate to their interpreters (interpretant/signified), or more simply stated, what signs mean. Pragmatics is "the relation of signs to their interpreters" (Morris, 1938, p. 30).

Morris (1938) further elaborated on the concept:

> Since most, if not all, signs have as their interpreters living organisms, it is a sufficiently accurate characterization of pragmatics to say that it deals with the biotic aspects of semiosis, that is, with all the psychological, biological, and sociological phenomena which occur in the functioning of signs. Pragmatics, too, has its pure and descriptive aspects; the first arises out of the attempt to develop a language in which to talk about the pragmatical dimension of semiosis; the latter is concerned with the application of this language to specific cases. (Morris, 1938, p. 30)

In short, pragmatics is the study of how sign vehicles are interpreted. As will be discussed, pragmatics explains how different sign vehicles can be interpreted differently by different interpreters. This is a particularly important point for this study, as the goal is to capture

the meaning of Russian military map symbols and terms, as was intended by the map makers that created them.

Cartographic Communication

In addition to cartosemiotics, this study also considered the closely related topic of map communication models used in cartography. Map communication models originated after the Second World War due to the use of propaganda cartography in both world wars, and later in the Cold War, to promote state interests by manipulating the masses through cartographic misrepresentations. Map communication models were seen as a way of restoring trust in cartography by rationalizing the map-making process and establishing cartography as a scientific discipline of communication science, as opposed to the earlier view that cartography was simply a combination of art and science, thereby giving cartography empirical objectivity (Kent, 2018, pp. 97-100).

> The emergence of theories of cartographic communication after the Second World War, a conflict which had seen the proliferation of propaganda mapping and the erosion of trust in cartography, aimed to rationalize the process of map creation and to establish cartography as a scientific discipline. In order to succeed under the post-war hegemony of modernism, cartography would therefore come to rely on the values of scientific inquiry, such as objectivity and empirical research, to provide its authority, purpose, and direction. In particular, cartography was redefined as a communication science 'as distinct from a rather unwieldy art-science relationship, regarded by many as an uncomfortable operating zone'. (Kent, 2018, p. 96)

American Geographer, Arthur H. Robinson author of "Elements of Cartography", a textbook which became the standard cartography textbook for decades, said that this transition was a 'revolution [that] appears long overdue in cartography' (Crampton, 2001, p. 235; Robinson, 2010, p. 13). Robinson was considered to be at the forefront of this transition and made an analogy between modern architecture and this new model of map

communication. Just as modern architecture changed the focus of architecture to building structures that conform to the needs of the users, instead of the users conforming to the structure, Robinson (2010) believed that maps should conform to the needs of the users, instead of the users attempting to conform to the map, so that 'function provides the basis for the design' (Robinson, 2010, p. 13).

In terms of differences of how this change in focus differed from previous cartographic thinking, map communication models generally function by understanding and controlling the factors that affect map use, while earlier theories were only concerned with technical aspects of map creation (accuracy, projection, etc.). But in map communication models, not only is the role of the user considered, but it is thought to be just as important as that of the technical skills of the mapmaker (Kent, 2018, pp. 98-99). The geographer Crampton (2001) stated that the four main principles of the map communication model included the following: 1. The cartographer and map user are distinct entities; 2. The map functions as an intermediary between the cartographer and the map user; 3. The map is the medium through which communication occurs between the map user and cartographer; and 4. The cartographer must have an idea of the map reader's ability to comprehend the information presented in the map (p. 237).

One of the first, and best known, map communication model was proffered by A. Koláčný. In his seminal 1969 article "Cartographic Information: a Fundamental Concept and Term in Modern Cartography," Koláčný (1969) explained that the process of cartographic production and process of cartographic understanding must be looked at as one process (p. 47). As can be seen in Figure 3.2, and given Crampton's description, there

are obvious similarities between map communication models and semiotics, in particular, both approaches acknowledge the role of the map user (interpreter/interpretant in semiotic parlance) and the triadic relationship between cartographer, map, and map user. Sless (1986) stated that these models "break up communication into three domains: all the activities or processes which go toward the making of the messages, the domain of the message itself, and the domain of the receiver of the message" (Sless, 1986, p. 12).

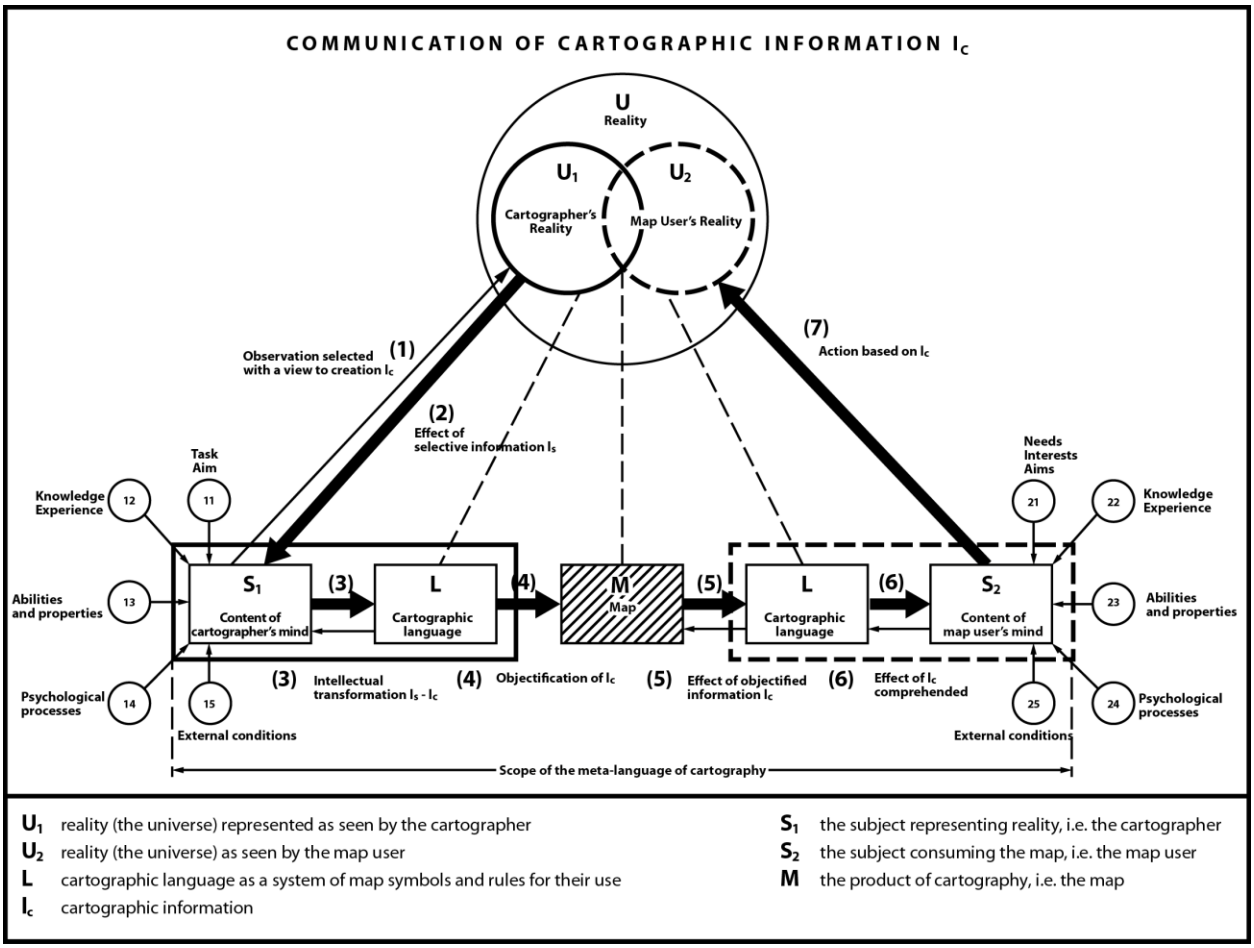


Figure 3.2. Communication of cartographic information. Adapted from "Cartographic Information: a Fundamental Concept and Term in Modern Cartography," by A. Koláčný, Cartographic Journal, (6)1, p. 48, Copyright 1969 by Taylor & Francis. Adapted with permission. (See Appendix C).

An important aspect of both the semiotic and cartographic models of communication is an understanding that communication is not simply a mathematical determination of what proportion of information sent by the sender is received by the receiver. In both models, the receiver of the information does not just receive a portion of sent information, but often the receiver can derive more information than what is provided by the representation (sign vehicle/map) (Salichtchev, 1973, pp. 108-109). This occurs because the interpreter/receiver often fuses this information with other knowledge in the process of semiosis/cartographic communication. For example, a military commander may read a map and understand that an area on a map has thick vegetation, and has contour lines close together (meaning a sudden elevation change), but the commander combines this information with the knowledge of his personnel, vehicles, and equipment, and can ascertain the capability of his unit to traverse this terrain and the speed at which it can be accomplished. For the military commander, the 'meaning' acquired for topographic is not just one of landcover and elevation, but also movement and maneuver. A geologist that reads the very same map, will have a very different interpretation. The geologist looks at the topography and may be able to form opinions about probable subsurface features (geomorphology). Although the map (sign vehicle) and territory (denotata) are the same in this situation, the difference in the meaning of the map between the commander and the geologist is the pragmatics of their interpretation. The Soviet geographer and cartographer Konstantin Salichtchev has a similar view and makes the point that the "very possibility of obtaining new knowledge from maps lies at the basis of the use of maps as a means of

scientific research, particularly in the devising of hypotheses, forecasts, recommendations, etc." (Salichtchev, 1973, p. 109).

Application of Communication and Understanding Methodology

Relevant to this study is the belief that the interpreter of a cartographic representation can create additional meaning from what is otherwise contained in it. This is because Russian military mapmakers are creating maps that are intended to be interpreted by others in the Russian military. This means that the problem of understanding Russian military symbology and terms is not just one of simply translating the individual words, acronyms, and symbols encountered on Russian maps, but it must also include an understanding of Russian military tactics and doctrine that is often very different than the US/NATO system, which many foreign map readers are often accustomed. The fact that the US/NATO system is the most prevalent system of military map symbology and terms presents some problems and benefits, as will be further discussed in the following chapters. But generally speaking, problems tend to arise from those familiar with the US/NATO system making incorrect assumptions about the Russian system that lead to misinterpretations of Russian military map symbols and terms. This situation is due to the Soviets/Russian symbology system being designed to accommodate the Soviet/Russian way of war, while the US/NATO symbology system was designed to accommodate the NATO way of war. A semiotic approach assists in explicitly identifying differences in meanings, and the underlying structures that have created them, so Russian map symbology and terms can be more accurately understood as the map maker intended.

To acquire the fullest understanding possible, this study focused on the semiotic relationship between the map, map symbols, and terms (sign vehicles) and the map reader (interpreter), what Morrison describes as 'pragmatics'. Given this focus, this study was particularly interested in the role of the interpreter in the semiotic triadic process, as it "constantly changes each time the classification process is undertaken anew" (Sless, 1986, p. 142). The interpreter was the only variable that can be changed in this study, and this variable is manipulated by imparting to the interpreter relevant aspects of Russian military organization, tactics, and doctrine. This manipulation was intended to make the underlying structure of the Russian military system known, thereby allowing those unfamiliar with the Russian military system a more complete understanding of Russian military maps.

This study was primarily intended to manipulate the interpreter's understanding by imparting a knowledge of the underlying structure, but it also makes use of some comparative means to impart understanding. This was accomplished through the occasional comparison of Russian military map symbols and terms to approximate US/NATO equivalents. Although there can be significant differences in the meaning of similar symbols and terms between these systems, the US/NATO map symbology and terms are likely the most well-known of such systems, and therefore comparing and contrasting the similarities and differences can do much to facilitate understanding and ease comprehension. The referencing of US/NATO map symbology and terms and its system of organization and categorization also served another purpose in this study. The application of this system to Russian military map symbology and terms provided metrics

for comparison. These metrics are crude, but provide a quantifiable means of assessing this study's methodology.

Categorization Methodology

An understanding of the Russian military organizational system and doctrinal semantic stylization is essential for a semiotic understanding of the meaning of Russian map symbology and terms. But simply just translating symbols and terms is not sufficient to fully understand the structure of how they are related. To accomplish this objective, they must be modeled upon the Russian military system that they are representing. Korzybski (1994) summed up this sentiment best when he stated that "A map is *not* the territory it represents, but, if correct, it has a *similar structure* to the territory, which accounts for its usefulness" (Korzybski, 1994, p. 58). Korzybski's definition of 'structure' is that the map and the territory (abstraction and the abstracted) have the same relations and multidimensional order (Korzybski, 1994, p. 751).

Categorization or Classification?

If there is an intent to develop a 'similar structure' between abstract and abstracted, there should be some consideration of the differences between categorization and classification. An in-depth discussion of these differences was beyond the scope of this study, but to adequately organize Russian military map symbology and terms, short definitions of these terms are required. Jacob (2004) described the former as: "Categorization is the process of dividing the world into groups of entities whose members are in some way similar to each other" (Jacob, 2004, p. 518). In comparison, Jacob (2004) described the latter as: "Classification as process involves the orderly and systematic

assignment of each entity to one and only one class within a system of mutually exclusive and nonoverlapping classes" (Jacob, 2004, p. 522).

> The generic classification process, as defined above, is quite simple. The only basic rule is that the classes formed must be both *exhaustive* and *mutually exclusive*. This means that if *N* persons are to be classified, there must be an appropriate class for each (exhaustivity), but only one correct class for each, with no case being a member of two classes (mutual exclusivity). Thus, there must be one class (but only one) for each of the *N* persons. (Bailey, 1994, p. 3)

In general, classification has a more rigid definition and allows an entity to be only placed in one class, while categorization allows entities to be placed into one or more categories. Due to the nature of these symbols and terms, the use of categories was deemed most appropriate, as it is not uncommon for these entities to be found in multiple categories. For instance, a medical platoon could be found in the Ground Forces, Naval Infantry, Airborne Troops, and Aerospace Forces; or a particular helicopter may serve as both reconnaissance and a medical evacuation vehicle.

Only through an ordered process of placing Russian map symbology and terms in their appropriate categories, so they have the same relations and multidimensional order as the Russian military they represent, may a semiotic understanding be achieved. The importance of this 'ordering of chaos' concept is best explained by the Italian scholar and the most prominent semiotician of recent years, Umberto Eco (1932 – 2016).

> The list is the origin of culture. It's part of the history of art and literature. What does culture want? To make infinity comprehensible. It also wants to create order — not always, but often. And how, as a human being, does one face infinity? How does one attempt to grasp the incomprehensible? Through lists, through catalogs, through collections in museums and through encyclopedias and dictionaries. There is an allure to enumerating how many women Don Giovanni slept with: It was 2,063, at least according to Mozart's librettist, Lorenzo da Ponte. We also have completely practical

> lists — the shopping list, the will, the menu — that are also cultural achievements in their own right." (Beyer & Gorris, 2009)

Eco's 2009 book *The Infinity of Lists*, is essentially a study of the great 'lists' of Western culture. Eco uses two lists in Homer's *The Iliad* to illustrate the two ways in which lists help us understand our world. The first, in Book XVIII, described the great shield that Hephaestus made for Achilles, starting at the shield's center and radiating outward layer by circular layer the cosmos is revealed. This is a closed, finite list, with no possibility of addition. The second, in Book II, is "The Catalogue of Ships" a 350-line list describing the Greek forces deployed to Troy, which has the feeling of being open-ended, indeterminate, and infinite in nature (Eco, 2009, pp. 9-18). The classist Beard (2009) believed, "Eco leaves us in no doubt which style of representation he prefers: the boundless list" (Beard, 2009). Although Eco's description of the great lists of Western civilization is a far different topic than the requisite lists required to organize Russian military map symbology and terms, the principle remained the same- lists can facilitate understanding of complex phenomena. In relation to Russian military map symbology and terms, considering Carl von Clausewitz's theory of the ever-changing character of war, and by extension how militaries must adapt to accommodate these changes; and the fact that knowledge of the phenomena that is the Russian military is almost certainly imperfect, Eco's open-ended lists were deemed most appropriate.

The adoption of a categorization instead of a classification does present some challenges. If each entity is a member of only one class, there are many standard classification methods that may be applied to conduct analysis, such as defined interval, (every class has the same specified number of units), manual interval (the number of units

is defined for each class), quantile (each class contains an equal number of features), equal interval (the range of unit values is divided into equal-sized subranges), among many others. Perhaps the most popular of which is the Jenks natural breaks method, developed by preeminent cartographer and University of Kansas professor, George F. Jenks (1916-1996), for primarily choropleth mapping purposes. Jenks recursive algorithm was designed to find the optimal class range, or 'natural' data breaks in a given data set by finding the least amount of interclass variance (Jenks, 1977). Although this staple method of quantitative classification cannot be directly applied to the qualitative categorization of Russian military symbology and terms, it is apparent that this data should be organized by some type of 'natural' method that optimizes categorization.

If the 'ordering of chaos' is important as Eco suggests, how does one go about organizing this qualitative data in 'natural' categories? Professor of psychology Eleanor Rosch, the preeminent scholar of categorization and prototype theory, claimed that two basic principles govern the creation of well-formed categories. The first is 'cognitive economy', or the generally common-sense notion that humans want categorization systems that provide the most amount of information with the least amount of cognitive effort. The second is 'perceived world structure', or belief that information is not just a collection of unstructured random occurrences, but a set of structured information. These principles are mutually constitutive, as the most amount of information with the least amount of cognitive effort is most easily achieved when categories are aligned to the perceived world structure as possible (Rosch, 1978, pp. 3-4). Rosch (1978) defined a category as the "number of objects that are considered equivalent", which are usually designated by names

(Rosch, 1978, p. 5). She posited that category systems have a horizontal and vertical dimension. The horizontal dimension is how the category is segmented, such as rifle platoon, mortar platoon, signal platoon, engineer platoon, etc. The vertical dimension is the category's level of inclusiveness, such as platoon, company, battalion, brigade, etc. An important aspect of Rosch's work is how she organized categories, or taxonomy, which is defined as "a system by which categories are related to one another through class inclusion" (Rosch, 1978, p. 5). Given this understanding, it is proposed that Rosch's principles of 'cognitive economy' and 'perceived world structure' could well provide a 'natural' method for the 'ordering of chaos' so that abstract Russian military map symbology and terms have a 'similar structure' to the abstracted Russian military that they represent.

Taxonomy or Typology?

The appropriate organization of Russian military map symbology and terms is essential to ensuring that the abstract (Russian military map symbology and terms) has a similar structure to the abstracted (Russian military). In Rosch's model, the organization of categories is done by way of taxonomy, but some discussion on the difference between the term 'taxonomy' and the closely related term 'typology' is warranted for this particular application. A noted scholar of taxonomies and typologies, sociologist Bailey provided a detailed account of these differences, and his ideas can be contrasted with the previously discussed authors. Unlike Jacob, Bailey does not appear to see any difference between classification and categorization and unlike Rosch, he does not see taxonomies as simply a

way of organizing categories. Instead, Bailey proposes that there are two primary means of classification (categorization) — taxonomies and typologies.

Bailey's methods of classification vary based on two theoretical criteria, dimensionality and level of analysis. Dimensionality refers to if the classification is based upon a single attribute (unidimensional) or multiple attributes (multidimensional) of the entity being classified. For instance, a unidimensional variable could be weight, speed, etc., while a multidimensional variable could be socioeconomic status. The 'level of analysis' refers to whether the criteria of classification are based upon empirical, conceptual, or a combination of empirical and conceptual attributes of the entity being classified. Given these criteria, Bailey (1994) defined taxonomy as an empirical and unidimensional classification method primarily used for empirical entities, which is typically hierarchical. A typology is defined as a multidimensional and conceptual method primarily used for conceptual entities. Bailey pointed out that taxonomies are more often used in the physical sciences, while typologies are used in the social sciences (Bailey, 1994, pp. 3-6). Bailey may have different definitions and concepts than the previously discussed authors, but he acknowledged the same fundamental problem of determining which characteristics to best conduct the process. "One basic secret to successful classification, then, is the ability to ascertain the key or fundamental characteristics on which the classification is to be based…Unfortunately, there is no specific formula for identifying key characteristics" (Bailey, 1994, p. 2).

Despite the authors' vastly different backgrounds, it appears that similar themes are apparent. Rosch's principles of 'cognitive economy' and 'perceived world structure' could

well nest with Bailey's ideas about taxonomies and typologies, as Rosch's principles can assist in identifying Bailey's "key characteristics" upon which classification can be based. In terms of how categorization facilitates understanding, Bailey (1994) stated that "a well-constructed typology can be very effective in bringing order out of chaos. It can transform the complexity of apparently eclectic congeries of diverse cases into well-ordered sets of a few rather homogeneous types" (Bailey, 1994, p. 33). This sentiment can be seen in Eco's lists that that "create order" and "make infinity comprehensible" (Beyer & Gorris, 2009).

With the different definitions of taxonomies and typologies in mind, this study used taxonomies to classify the appearance of the symbols and their hierarchical relationships, but a typology to describe the more subjective attributes. In terms of employment, the use of taxonomic categorization needs little explanation, as taxonomies generally more mundane characteristics of appearance and hierarchical relationships. But conceptual typologies are a different matter and, in some cases, warrant theories of their own, as will be explained in greater detail.

Typology as Scholarly Theory

Although a theory is traditionally defined as a system of ideas intended to explain something, not all theories fall under this definition. A few scholars have proffered that typologies are unique kinds of theories (Doty & Glick, 1994).

> Typology as a theory is more complex than traditional theories because it has the capacity to capture the various causal relationships involved instead of interaction between only two variables. That is why Doty and Glick argue that a well-developed typology can be considered as a unique form of theory that includes a grand theory and multiple middle-range theories. A grand theory of a typology predicts a level of dependent variables based on the "fit" between the features of existing entities and the ideal types. (Niknazar & Bourgault, 2017)

There are no universally recognized features that constitute a given idea qualifying as a theory, but Doty and Glick proffered that the following three criteria are present in all theories, and can be found in typologies: "(a) constructs must be identified, (b) relationships among these constructs must be specified, and (c) these relationships must be falsifiable" (Doty & Glick, 1994, p. 33).

Perhaps the biggest theoretical difference between taxonomies and typologies is typologies' use of the use of 'ideal types'. The use of ideal types is a fundamental difference that can be best explained in terms of how categorizations are conducted between the methods. Taxonomies tend to use simple rules that can be described as 'if-then' statements to categorize entities based upon a given attribute, but typologies typically use the concept of sociologist Max Weber's 'ideal types', as Weber states.

> An ideal type is formed by the one-sided *accentuation* of one or more points of view...In its conceptual purity, this mental construct cannot be found empirically anywhere in reality. It is a utopia. Historical research faces the task of determining in each individual case the extent to which the ideal-construct approximates to or diverges from reality, to what extent for example, the economic structure of a city is to be classified as a city economy. (Weber, 1949, p. 90)

An in-depth description of ideal types is beyond the scope of this study, but the term can most easily be explained as a theoretical abstraction in which a proposed entity has all given characteristics of a phenomenon. This entity may or may not exist in reality, it is simply a conceptually pure model used to facilitate categorization. As Blalock (1969) explained, one of the principal values of ideal types is that they "provide an abstract model, so that deviation from the extreme or ideal type can be noted and explained" (Blalock, 1969, p. 32).

Application of Categorization Methodology

Although the organization of Russian military map symbology and terms is not inherently a semiotic endeavor, this study employed organizational theories in tune with semiotics and its underlying basis in structuralism. This was accomplished by organizing Russian military map symbology and terms so they have the same relations and multidimensional order, or in other words have a similar structure, as the phenomena they represent. There is no mathematical formula to determine the best organizational scheme but using Rosch's principles of 'cognitive economy' and 'perceived world structure', this method provided 'natural breaks' to categorize the data. This was accomplished by conducting a detailed examination of the Russian military and then organizing the map symbology and the terms, so the latter has a 'similar structure' to the former. Or more simply stated, ensuring the abstraction mirrored the abstracted.

Since the primary purpose of this study was to convey the meaning of Russian military map symbology and terms to Western readers as was intended by Russian mapmakers, the study not only mirrors Russian military map symbology and terms with the military it represents but also has to present this information to (primarily Western) readers in terms he or she can most readily understand. [Since the relationship between signifier and signified is learned, the only way for the same meaning to be conveyed between two individuals (interpreters), is to ensure that they have a shared common set of norms to facilitate communication and understanding.] For this to be accomplished, Russian military map symbology and terms were not only categorized according to their 'natural breaks', but also according to US/NATO standards. [In practice, this means

Russian military map symbology and terms have been classified according to the Russian and US/NATO systems of organization.] The topologies were formed following Doty & Glick's five guidelines for a topology theory: 1. Typological theorists should make explicit their grand theoretical assertion(s). 2. Typologies must define completely the set of ideal types. 3. Typologies must provide complete descriptions of each ideal type using the same set of dimensions. 4. Typological theories should explicitly state the assumptions about the theoretical importance of each construct used to describe the ideal types. 5. Typological theories must be tested with conceptual and analytical models that are consistent with the theory (Doty & Glick, 1994).

This study used several taxonomies and typologies to categorize Russian military map symbology and terms. Research has focused upon the Russian organizational system, but US/NATO organizational categories have also been included. To facilitate the indexing of Russian military map symbology and terms in a database, a few other generic categorizations were used. These generic categorizations typically concerned the general function of the symbol or term, or the appearance of the map symbols. Also, Russian terms were grouped together by 'families' of similar terms. For example, the terms "tank brigade", "tank battalion", "tank company", and "tank platoon" would be grouped together in the "tank" family. The intent of this organizational scheme was to organize information and facilitate understanding, but the process of understanding these typologies and hierarchical relationships not only yielded information about the map symbols and terms themselves, but also about the phenomena (military) that they represent.

Database Methodology

To meet the study objectives, after the appropriate taxonomies and typologies were developed, they were modeled in a database to facilitate storage and exploitation. A relational database was deemed the best means for accomplishing this objective. The relational database model has been around since 1970 and was first developed by Edgar F. Codd a programmer from the *International Business Machines Corporation* (Codd, 1970). Before this revolutionary idea, data was stored hierarchically, much like the extensible markup language (XML) format. Although hierarchical data schemas such as XML are fine for many applications, there can be data redundancy problems that can eventually lead to data errors in certain situations. Relational databases overcome many of these problems by storing data in tables, with each table consisting of multiple columns somewhat like a *Microsoft Excel* spreadsheet). Each row, or 'record' contains a unique instance of data and each table has a primary key. A primary key is a column whose data uniquely identifies each row in the table. A foreign key is a column in one table that refers to a primary key in another table. By 'joining' primary and foreign keys from different tables, data can be expressed in a relational format. Most relational databases enforce entity integrity to ensure that the primary key in the tables is unique, and referential integrity to ensure foreign key values are found in the primary key column of its associated table. Despite relational database theory originating in the 1970s, there has been no substantive change to this architecture as described (Rouse, 2018). Most database design research involves not changing this fundamental architecture, but developing the best data model to store data in

real life, complex situations, such as the typologies and taxonomies developed for this study of Russian military map symbols and terms.

A relational database met the requirements for this study, because of its capability to store the alphanumeric, imagery, and associated metadata required. Also, a relational database can support many data categories (typologies and taxonomies), easily integrates with other applications, enforces referential integrity, and improves data sharing. Although a relational database is ideal for storing and categorizing information, since this study dealt with some interpretive aspects, a substantial textual narrative was required to put the database in the proper context, which can be found in the following chapter.

As can be seen in Figure 3.3., an entity-relationship model (ER model) was sketched to determine the different relationships between the two main entities — symbols and terms (shown in red), the entities used to define the taxonomies and typologies (shown in blue), and the entities that join them together (shown in green). In addition to the database tables, the primary keys (annotated with a "PK"), foreign keys (annotated with a "FK"), and the cardinalities (the lines linking the tables) have been defined as having "one-to-many" relationships, annotated by the number "1" and the "infinity" symbol respectively. This schema was then replicated in a *Microsoft Access* relational database. Most data relationships were modeled with structured query language (SQL), but in some instances, SQL was not capable or ill-suited to the task, so in these instances some coding with *Visual Basic* was necessary.

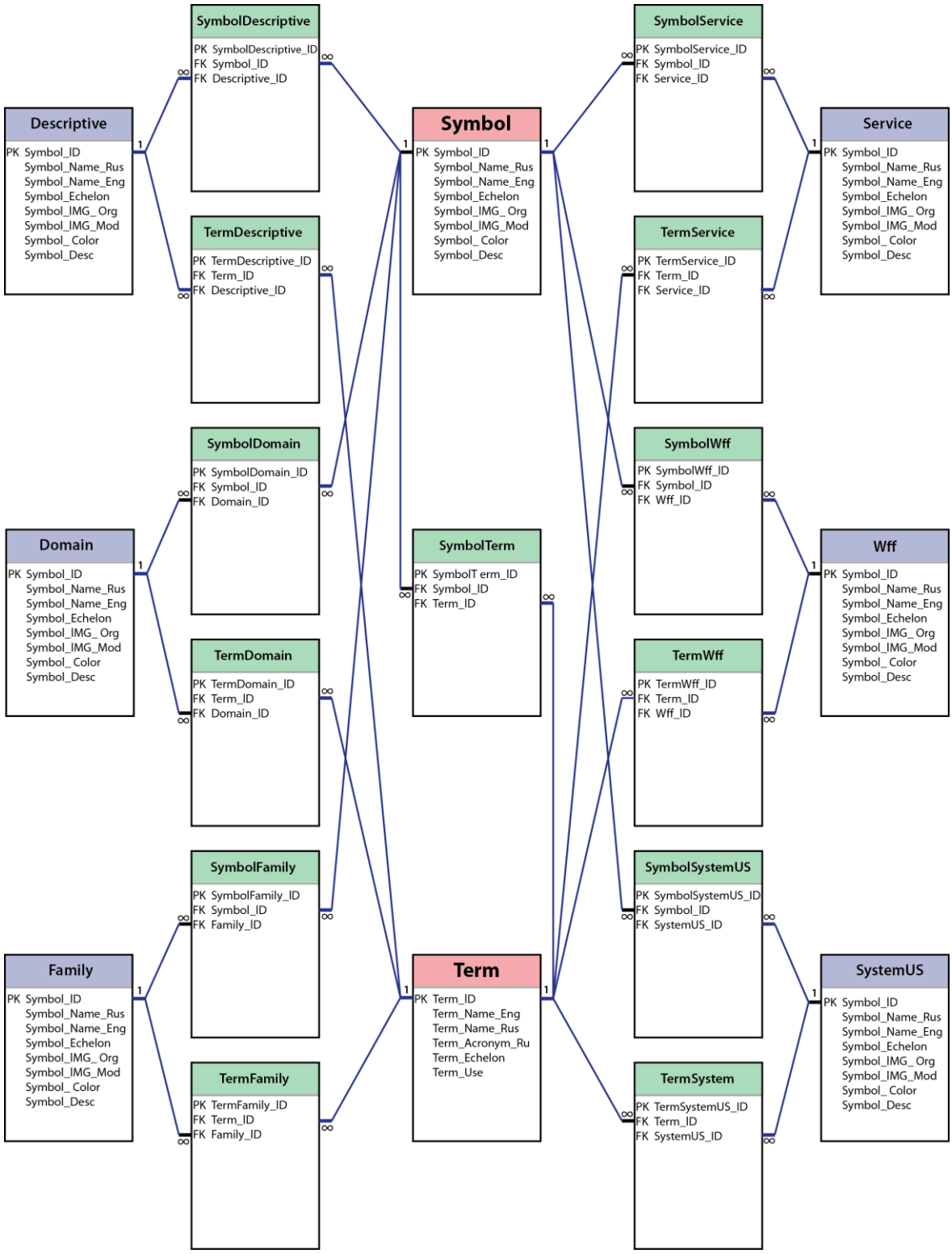


Figure 3.3. Entity-Relationship model developed for study

Data Acquisition

The data for this study has was collected from a variety of sources. Unlike the US/NATO system, where military terms and symbols can be easily found in certain foundational documents such as *NATO Joint Military Symbology (*NATO Standardization Agency, 2011), *DOD Dictionary of Military and Associated Terms* (Office of the Chairman of the Joint Chiefs of Staff, 2020), and *Terms and Military Symbols* (Department of the Army, 2018), finding the military symbols and terms of the Russian system required looking at many different sources. As will be discussed, Russia does have excellent terminology guides that may be consulted, but there is no single reference for the vast number of symbols and terms that may be encountered on Russian military maps. This is because the most used symbols, terms, and acronyms are disseminated by the Russian General Staff, but specialty symbols, terms, and acronyms are developed by their respective communities in the Russian Armed Forces. [These specialties include areas as diverse as military deception, railroad operations, military meteorological units, etc.] Therefore, the data collected for this study can be described as coming from one of four general categories.

1. Russian military manuals and regulations: The Russian Federation routinely publishes a variety of military manuals and regulations that contain symbols and terminology. The most commonly used symbols are found in the Russian General Staff's *Boyevoy ustav sukhoputnykh voysk [Ground forces combat regulations]* (Ministry of Defense of the Russian Federation, 2014), a series of regulations that are updated every few years. Although these regulations are often updated, rarely do the symbols and

terminology change. When changes to symbols and terminology do occur, it is usually to represent new technologies that can be found on the battlefield, such as the unmanned aerial vehicle (UAV). In addition to general regulations, there is also specific guidance on the correct way to depict military map symbols and terms on maps, most notably *Pravila oformleniya i vedeniya boyevykh dokumentov [The correct marking and maintenance of combat documents]* (Andreev et al, 2006) and *Osnovy oformleniya i vedeniya rabochey karty komandira [Fundamentals of the marking and maintenance of the commander's working map]* (Rodionov et al, 2012).

Russian military manuals and regulations may not only contain maps but also (and more often) contain doctrinal templates.[5] Doctrinal templates consist of military map symbols, terms, and acronyms, but these elements are not overlaid upon a topographic map. The graphics are typically used to explain how to conduct various tactics and are presented in abstraction from the terrain to further this purpose, an example of which can be seen in Figure 3.4. After the tactic is presented in abstract form, it is not uncommon for Russian training materials to provide historical examples of how the tactic was employed. This analysis typically involves showing how the tactics parameters had to be adjusted for the operational environment.

[5] The term 'doctrinal template' used in this context is not a Russian concept. The author has chosen this term to describe the Russian military practice of using military map symbols and terms, without the maps themselves, to explain how tactics are conducted. Since the focus of this study is on military map symbols and terms, most examples in this study are of the 'doctrinal template' variety, as the overlay of these symbols on topographic maps of the appropriate scale can make the military map symbols and terms difficult to read or illegible on a standard 8.5"x11" page. In addition, the topographic maps can be distracting and take attention away from the focus of the study.

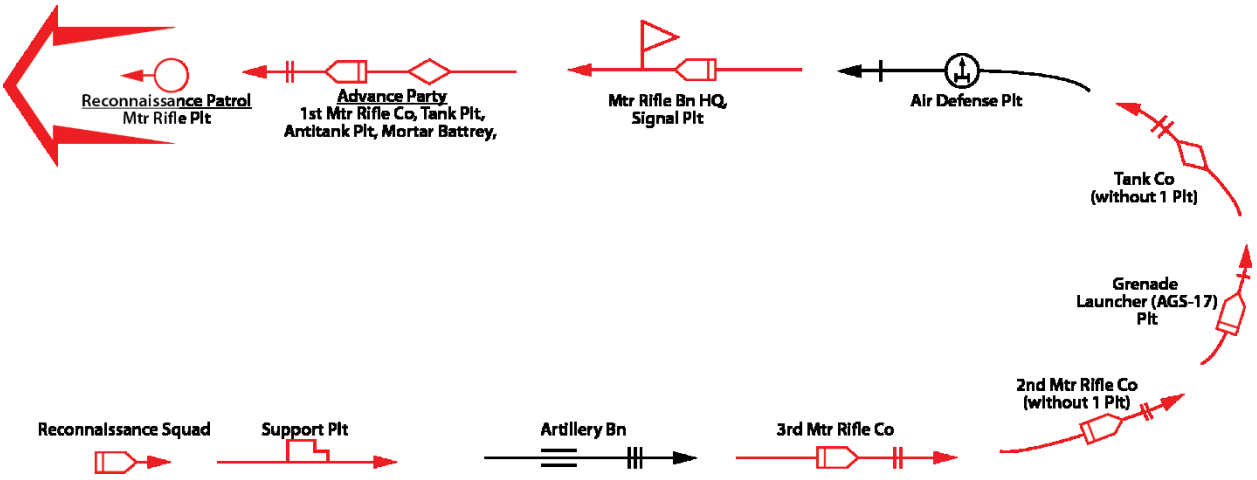


Figure 3.4. Example of a translated doctrinal template. From *The Russian Way of War: Force Structure, Tactics, and Modernization of the Russian Ground Forces*. (p. 172), by L. W. Grau, and C. K. Bartles, 2017, Fort Leavenworth, KS: Foreign Military Studies Office. In the public domain.

Official manuals were useful for determining the exact meaning of terms. This was important due to systemic differences between Russian and English (NATO) military terms. In the US system, there is little in the way of detailed definitions for most terms at the operational and strategic levels of war (Petersen, 2014, p. 2). But what definitions are available may be found in certain joint and branch-specific publications such as the US Army's *Terms and Military Symbols* (Department of the Army, 2018) and the Joint Chief of Staff's *DOD Dictionary of Military and Associated Terms* (Office of the Chairman of the Joint Chiefs of Staff, 2020); however, these documents have much less detail than the somewhat equivalent documents of the Russian Ministry of Defense's three-volume set of Russian military terminology, *Voyennaya mysl' v terminakh i opredeleniyakh: v trekh tomakh [Military thought in terms and definitions: In three volumes]* (Tyutyunnikov, 2018). As an example, the Russian publication has seven different definitions and devotes

three pages to the concept of 'strategy', while the *DOD Dictionary of Military and Associated Terms* has a rather paltry one definition with 27 words on same the topic. (Tyutyunnikov, 2018, pp. 158-161) (Office of the Chairman of the Joint Chiefs of Staff, 2020, p. 204).

Occasionally, references to topographic terminologies were required. In these instances *Uslovnyye znaki dlya topograficheskikh kart masshtabov 1:25000, 1:50000, 1:100000 [Symbols for topographic maps at the scales: 1:25000, 1:50000, 1:100000]*, (Military Topographical Directorate of the General Staff, 1983), *Topograficheskoye deshifrirovaniye aerosnimkov pri sozdanii kart masshtabov 10,000 i 25,000 [The topographic interpretation of aerial photographs for creating 10,000 and 25,000 maps]* (Volpe & Podobedov,1961), and *Uslovnyye znaki dlya topograficheskoy karty masshtaba 1:10000 [Symbols for topographic map at the scale of 1:10000]* (Central Research Institute of Geodesy, 1977), were used. In addition, a few non-Russian sources were consulted to include Eastview's *Russian Military Mapping* (Psarev, 2005), and the US Army's technical manual, *Soviet Topographic Map Symbols* (Department of the Army, 1958).

2. Russian training materials: This study employed two different types of formal training materials. The first materials are official training books usually produced by the Russian Ministry of Defense or General Staff. These books, such as *Rabochaya karta komandira [Working map of the commander]* (Pombrick & Shevchenko 1972), *Spravochnik ofitsera po topograficheskim i spetsial'nym kartam [Officer handbook for topographic and special maps]* (Psarev, 2003), *and Osnovy obshchey taktiki dlya*

podgotovki ofitserov zapasa artilleriyskogo profilya [The fundamentals of general tactics for the training of reserve artillery officers] (Zaritsky, Sergin, & Kharkevich, 2004), are widely disseminated and can be found for sale in most military university bookstores, and now online. The second type of formal training material are official training books produced by Russian military academies and training institutions. These organizations often produce their own textbooks such as the Ural Federal University's *Perepravy: Uchebnoye posobiye [Water crossings: Textbook tutorial]* (Shunyakov, Bondarev, Bagin, & Fokin, 2017), usually specializing in a particular field (artillery, air defense, engineering, etc.). These textbooks often contain Russian military maps and/or graphics.

Aside from formal training materials, this study also employed informal training materials. These ephemeral training documents were found in forms such as *Microsoft PowerPoint* presentations and *Word* documents, which were created by professors and students to facilitate the understanding of concepts and as study aids for exams. These documents were usually found on educational institution websites or on social media platforms, such as the *Vkontakte* social media website, the Russian version of *Facebook*.

3. Military journals: The Russian military produces several military journals that often contain pertinent maps and graphics. The journal that was most used for this study was *Armeyskiy Sbornik [Military Digest]*, a monthly periodical produced by the Russian Ministry of Defense for the servicemen in the Ground Forces, Navy, and Aerospace Forces. *Armeyskiy Sbornik* was the only source that regularly provided historical military maps, graphics, commander's working maps, and descriptions of their employment. This study also used *Voyennaya Mysl [Military Thought]*, a publication of the Russian General

Staff. Although *Voyennaya Mysl* is more of an academic journal for mid and senior grade officers, it has produced a few articles relevant for this study.

4. Russian maps: Perhaps the most prominent sources for Russian military symbols, terms, and acronyms found on Russian military maps, are the maps themselves. The Russian military maps used for this study are generally of two different types. The first type are historical maps created for training or educational purposes. These maps are often drafted years after the events they portray, and almost always contain additional information that the belligerents were unaware of at the time of the events depicted. This information includes such things as exact friendly and enemy troop dispositions, as it is not uncommon to discover that enemy and friendly units were in different locations than commanders believed during the battle due to the 'fog of war'. Historical maps were found in many of the aforementioned sources and are routinely discussed in Russian military educational settings.

The second type of maps are 'commander's working maps', a topic that will be explored in greater detail in the following chapter, but these maps can generally be described as a tool of Russian commanders and staffs to depict the current disposition of forces and plans for battle. Much as the historical map is a guide to the past, the commander's working map is a blueprint for the (desired) future. Although these maps are regularly created by military commanders and their staffs, these documents are usually not disseminated outside of the Russian military, and so are rarely encountered.

This chapter has developed a working methodology by employing some of the findings in this literature review. This methodology was generally based upon the

philosophy of pragmatism, abductive reasoning, and semiotics of Peirce, but uses Morris's refinements of Peirce's semiotic theories, examining the triadic relationship between map, user, and reality. This study posited a three-pronged cartosemiotic methodology for the understanding, organizing, and storing of Russian military map symbology and terms.

The first prong of this methodology described how Russian military map symbology and terms should be understood. This study proposed the map user (interpreter) does not simply determine what a given map symbol or term means, but also used his or her background and experiences to give context, and often provide a deeper level of meaning and understanding than could otherwise be gained from the information contained within the map. Therefore, this methodology was particularly focused upon Morris's concept of pragmatics, the relationship between signs and interpreters. As this study was premised on the belief that maps, and by extension map symbology and terms, and reality are relatively fixed, the only variable that could manipulated is the map user. This manipulation was accomplished through imparting the map user with knowledge of Russian military organization, tactics, doctrine, and best practices so the map user understood the underlying structure of the Russian military system, thereby giving him or her a more complete understanding of Russian military maps. Hence, the understanding of Russian military map symbology and terms is not just a problem of linguistics, but also a problem of cross-cultural communication.

The second prong of this methodology described how Russian military map symbology and terms should be categorized. This part of the methodology was premised on the belief that the process of categorization was not only conducted for sorting and

storage purposes but also to facilitate the understanding of complex data. This study proposed that the categorization of Russian military map symbology and terms should be done in a manner consistent with the phenomena that they represent. Although this study employed organizational theories from several different disciplines, these different theories of categorization were found to have much in common with semiotics and its underlying basis in structuralism.

The third prong of this methodology described how Russian military map symbology and terms should be collected, organized, and stored employing a relational database. This part of the methodology explored the technical aspects of how a complex data structure developed for understanding and categorizing Russian military map symbology and terms can be modeled in a relational database. In practice, this means placing the typologies and taxonomies developed for this study into a relational database and then associating the relevant symbols and terms as well as accounting for the myriad of institutional rules, bureaucratic norms, social practices, and customs that influence how the data should be understood and categorized. The following chapter describes the application of this three-pronged methodology to Russian military map symbols and terms and its results.

CHAPTER 4

RESULTS

To ask what a map is and what it means to map, therefore is to ask: what world are you mapping, with what belief systems, by which rules, and for what purposes?
— John Pickles, *A History of Spaces*, 2004

The proceeding chapter of this study has outlined a three-pronged cartosemiotic methodology for the understanding and organization of Russian military map symbols and terms. This chapter will describe the application of this methodology and its results. Since this study was predicated on the belief that the abstraction should mirror the abstracted, this chapter will begin with a description of the Russian military and explain Russian military terms and symbology within this context. This approach requires the description of two distinct types of organizations that coexist in the Russian military. The functional organization, the division of the whole based upon functional areas (artillery, air defense, engineer, etc.) and the organization of command and control, the way these functional forces are integrated and controlled in a hierarchical manner (battalions, companies, platoons, etc.). But before a detailed examination of Russian military map symbology and terms can begin, some explanation of the general structure of the Russian military is required.

Structure of the Russian Military

For this study, the Russian military is defined as the uniformed military forces serving the Russian Federation. The vast majority of these military forces serve in one of three ministerial-level branches of the government. The largest of these forces is the Ministry of Defense, which controls the Ground Forces (GF), Aerospace Forces (VKS), Navy (VMF), Strategic Rocket Forces (RVSN), and Airborne Troops (VDV), and supporting formations, which consists of approximately 850,000 uniformed personnel, as

shown in Figure 4.1.[6] The second largest is the National Guard of the Russian Federation (*Rosgvardiya*), formed in 2016, which includes the former Internal Troops (VV) of the Ministry of Internal Affairs, Special Rapid Response Detachments (SOBR), the Special Purpose Police Units (OMON), and a few aviation units. *Rosgvardiya* has an estimated 340,000 personnel. The third largest is the Federal Security Service's Border Service, which also controls the Russian Coast Guard, has approximately 170,000 personnel (Central Intelligence Agency, 2019).

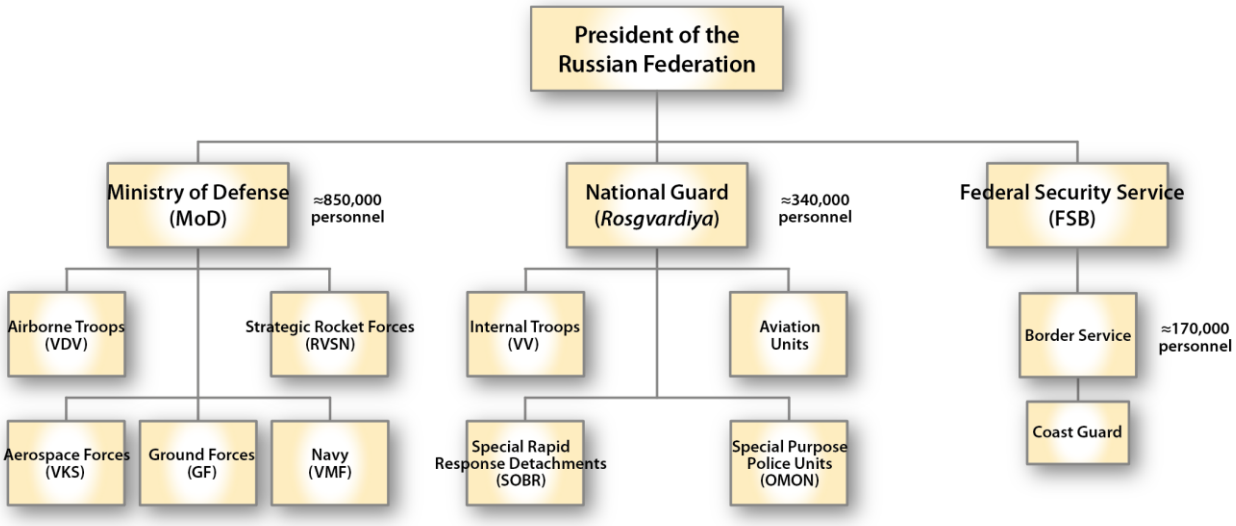


Figure 4.1. General military structure of the Russian Federation.

The Russian Armed Forces

Although this study incorporated terms and symbology for the entire Russian military, the focus will be on the military elements within the Russian Ministry of Defense,

[6] The Russian military divides these services into two distinct categories. The Ground Forces, Navy, and Aerospace Forces are each considered a 'branch of service' (*vid vooruzhennykh sil*), because these services each encompass an entire warfighting domain such as ground, sea, and aerospace, respectively. The Strategic Rocket Forces and Airborne Troops are each considered a 'branch of arms' (*rod voysk*), as they are integral parts of the Russian military and have their own specialized equipment, formations, and purposes, but do not encompass an entire warfighting domain.

which will be specifically referred to as the 'Armed Forces'. As seen in Figure 4.2., the majority of units that the Ground Forces, Aerospace Forces, and Navy consist of are operationally controlled by the military district (sometimes referred to as a joint strategic command) in which the unit is located. (Russia has five military districts: West, South, Central, East, and North.) Most Ground Forces units in a given military district serve in an army group (combined arms army, tank army, or army corps), most Aerospace Forces serve in an air and air defense army, while all naval forces serve in a Fleet or Flotilla. Although the Strategic Rocket Forces and Airborne Troops reside in the military districts, they are not subordinated to them, and instead report directly to the Russian General Staff (Grau & Bartles, 2017, pp. 28-29).

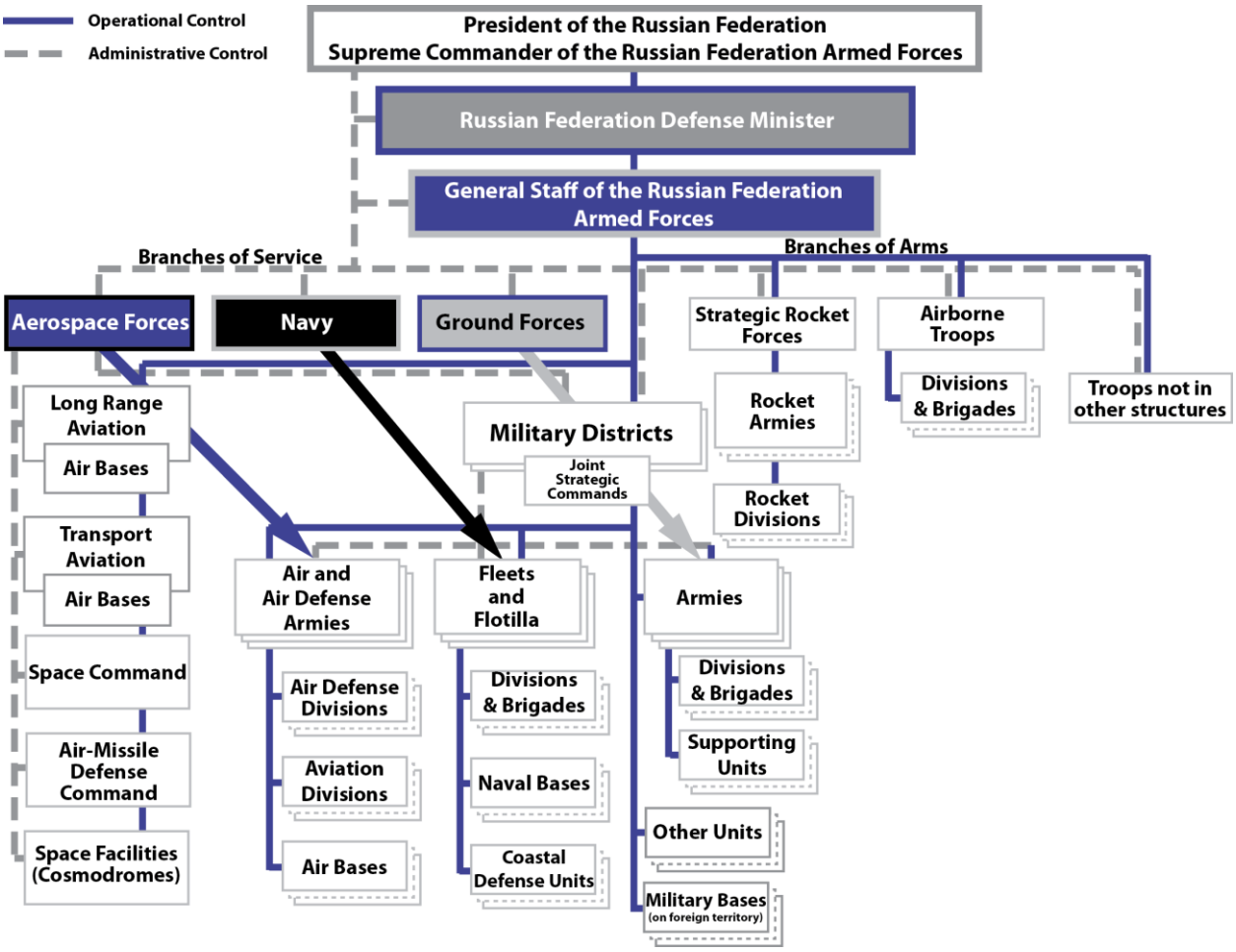


Figure 4.2. Command and control structure of the Russian Armed Forces. Adapted from *The Russian Way of War: Force Structure, Tactics, and Modernization of the Russian Ground Forces.* (p. 172), by L. W. Grau, and C. K. Bartles, 2017, Fort Leavenworth, KS: Foreign Military Studies Office. In the public domain.

Among these branches of the Russian Armed, this study focused on the Ground Forces. The emphasis on Ground Forces' symbology and terms is important for two reasons. The first is for practical reasons, as the Ground Forces are primarily concerned with a ground domain, as opposed to the Navy and Aerospace Forces which focus on the sea and aerospace domains respectively. The ground domain is the most familiar to

mankind, arguably has the most variance, and is where the majority of military actions occur. For these reasons, most Russian military map symbols and terms were developed by the Ground Forces to refer to the ground domain. The second reason is that the Ground Forces has been, and is, arguably the most important branch of service in the Russian Armed Forces. Imperial Russia and the Soviet Union traditionally considered themselves as 'land powers', and so have focused their militaries on the ground component. Although the importance of other domains has trended upwards, the Russian Federation still considers itself as primarily a 'land power'. The practical consequence of this thinking is that with a few exceptions relating to nuclear weapons, the Russian Navy and Aerospace Forces are generally seen to be in a supporting role to the Ground Forces for most conventional warfare scenarios. The proceeding section outlined the organizational command and control structure of the Armed Forces, the following section provides a more detailed account and explains their functional structures.

Ground Forces

The Ground Forces (*Sukhoputnyye Voyska*) is the largest and most versatile branch of the Russian Armed Forces, operating in the land domain. It is capable of conducting operations both independently and in cooperation with other branches of the Armed Forces, military formations in other ministries, and the military forces of allied nations. The Ground Forces missions include the following: the strategic deployment of the Armed Forces; engaging in, or preventing, local wars and regional conflicts; conducting defensive and offensive operations; repelling aerospace attacks and enemy landing forces; the conduct of territorial defense; and participating in peacekeeping and humanitarian actions.

Most Ground Forces units are assigned to one of Russia's 11 combined arms armies, 1 tank army, or 1 army corps, which are also referred to as 'army groups'. These formations typically consist of multiple motorized rifle and tank divisions and/or brigades and units that facilitate their operation. The typical line of command control is military district; army group; division/regiment or brigade; battalion; company; platoon; and squad. As seen in Figure 4.3., the Ground Forces functional organizations consist of four branches of arms (motorized rifle, tank, artillery, and air defense) and six specialty branches (reconnaissance, signal, electronic warfare, engineer, nuclear, chemical, and biological and defense, and material support). In practice, company-level units and below usually consist of just one of the aforementioned branches, while units' battalion-level and above usually consist of multiple branches. For instance, an air defense brigade will typically contain signal, material support, and other units necessary for its operation (Grau & Bartles, 2017, pp. 26-30).

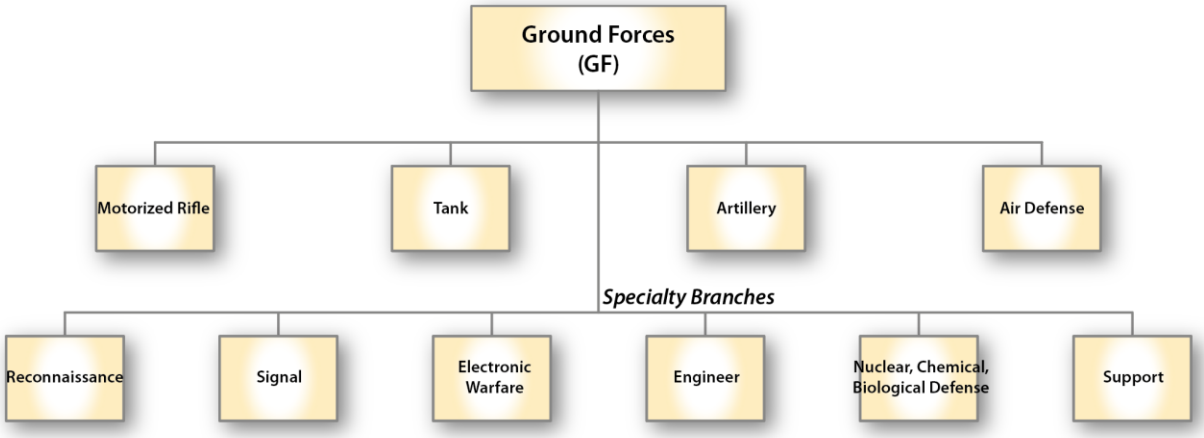


Figure 4.3. Functional structure of the Russian Ground Forces.

Aerospace Forces

Before 2015, the Russian Armed Forces had two branches of service focused upon the aerospace domain. The Aerospace Defense Troops, which was responsible for strategic air defense and space operations, and the Russian Air Force. In 2015, the Aerospace Defense Troops and Air Force were merged into the Aerospace Forces (*Vozdushno-Kosmicheskiye Sily*), thereby placing most Russian air and space assets in a single branch of service. The Aerospace Forces missions include the following: protecting Russian borders from air threats; preventing unauthorized aircraft from crossing state borders; defending military administrative, political, and economic facilities of vital importance to the state; acquisition and retention of air superiority; aviation support for other military forces; destruction of important enemy military, political, and economic facilities with both conventional and nuclear means; the launch and control of military satellites, and participating in peacekeeping and humanitarian actions. As seen in Figure 4.4., the Aerospace Forces are functionally aligned according to its three primary components: the Air Force, Air and Missile Defense Troops, and the Space Troops, which are responsible for aviation, strategic air defense, and space matters respectively. Most Aerospace Forces aviation and air defense are found within the five Air and Air Defense Armies which are subordinated to the military districts in which they reside. The formations consist of multiple aviation division, which has multiple aviation regiments of various types; and multiple air defense divisions, which have multiple air defense regiments and radiotechnical (radar) regiments. All space matters are controlled by the

15th Aerospace Forces Command, headquartered in Moscow (Grau & Bartles, 2017, pp. 384-388).

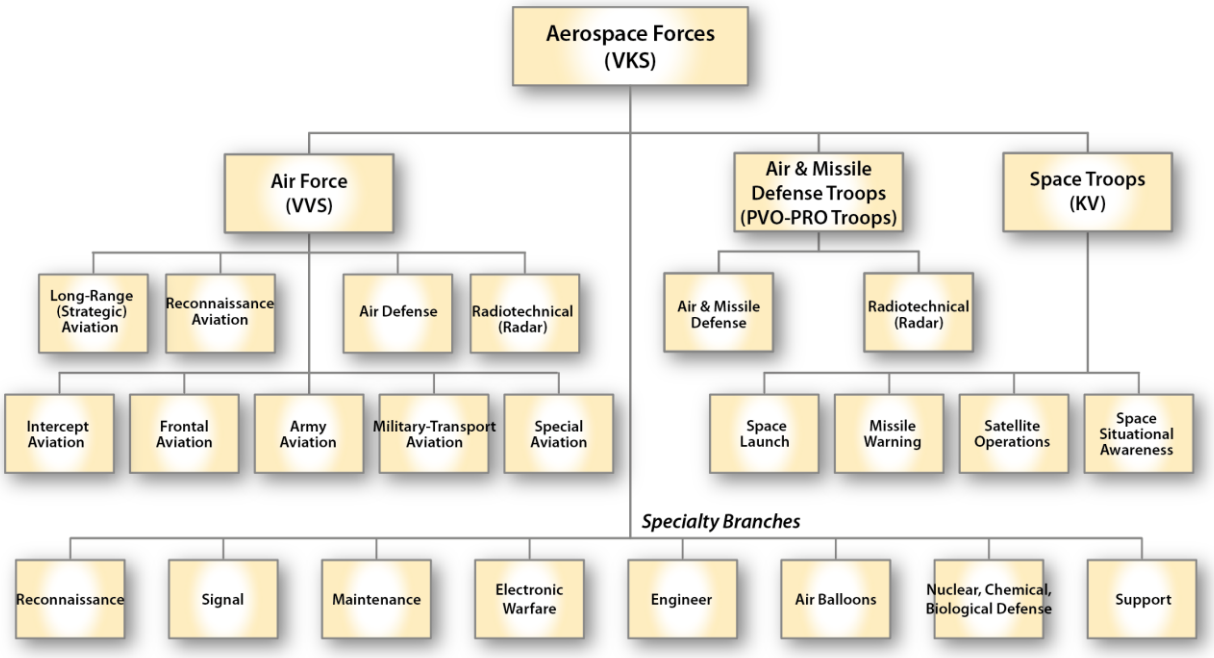


Figure 4.4. Functional structure of the Aerospace Forces.

Navy

The Russian Navy (*Voyenno-Morskoy Flot*) missions include the following: deterring threats; maintaining the sovereignty of territorial waters and sovereign rights in the exclusive economic zones and on the continental shelf; preserving freedom of action on the high seas; the creation and maintenance of conditions for ensuring the safety of maritime activities in the world's oceans; ensuring a Russia naval presence in the oceans, demonstration of the flag and military force, visits of ships and vessels of the Navy; and participating in peacekeeping and humanitarian actions. Functionally, the Navy consists of surface ships, submarines, naval aviation, coastal defense, and several specialty branches,

as shown in Figure 4.5. In terms of command and control, the Navy consists of four Fleets and one Flotilla, which are subordinated to the military districts in which they respectively reside. The surface ships and submarines in these formations are organized into divisions, which consist of multiple brigades, groups, and/or detachments, while naval aviation is organized by regiments or airbases. The Navy is also responsible for coastal defense, so the four Fleets and Flotilla have a ground component —The Coastal Defense Troops, which consists of the Naval Infantry and Coastal Defense Artillery to fulfill this function. In areas where the Fleets are located outside of the contiguous borders of the Russian Federation (such as the Black Sea Fleet in Crimea and the Baltic Sea Fleet in Kaliningrad) or in an extremely remote location (such as the North Sea Fleet in the Arctic), Russia has elected to create army corps that control both Coastal Defense Troops and Ground Forces units. These army corps do not report directly to the military district, but instead to their respective Fleet. Due to this organizational structure, the Russian Navy is the only branch with assets in the sea, air, and ground domains (Grau & Bartles, 2017, pp. 361-363).

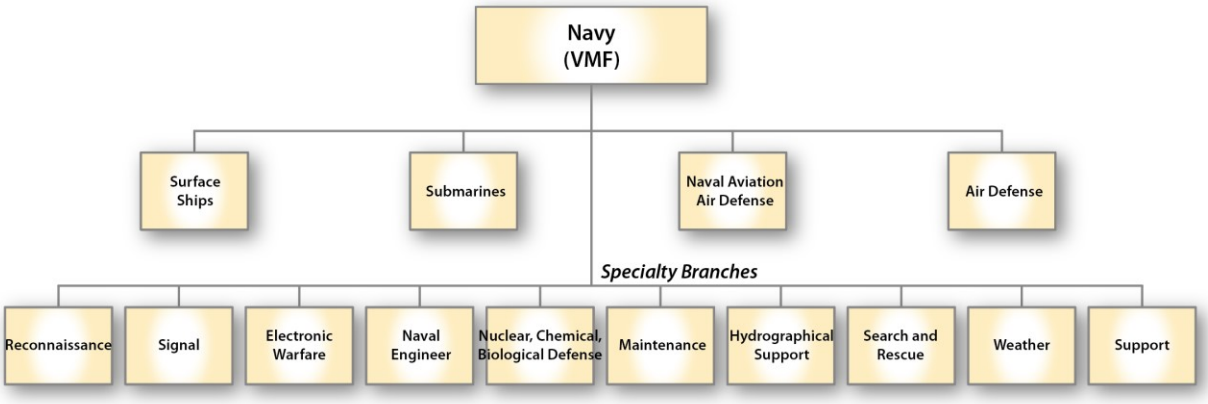


Figure 4.5. Functional structure of the Navy.

Strategic Rocket Forces

The Strategic Rocket Forces (*Raketnyye Voyska Strategicheskogo Naznacheniya*) operates the land component of the Russian strategic nuclear triad. [The other components being submarine-launched cruise ballistic missiles, operated by the Navy, and air-launched nuclear cruise missiles operated by the Russian Air Force.] The primary weapon systems of the Strategic Rocket Forces are mobile and silo-based intercontinental ballistic missiles. The mission of the Strategic Rocket Forces is to provide deterrence, through the capability of destroying enemy nuclear weapons, military facilities, and economic infrastructure (Ministry of Defense of the Russian Federation, n.d.). The Strategic Rocket Forces report directly to the Russian General Staff, and consist of three Rocket Armies, that each has multiple rocket divisions, and is organizationally aligned as shown in Figure 4.6.

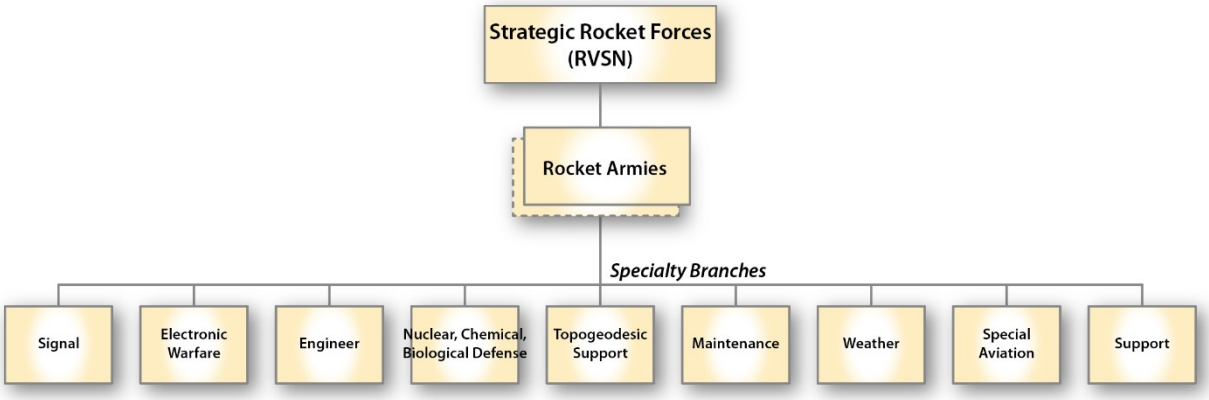


Figure 4.6. Functional structure of the Strategic Rocket Forces.

Airborne Troops

The Russian Airborne Troops (*Vozdushno-Desantnyye Voyska*) is the Russian General Staff's airmobile reserve. The mission of the Airborne Troops is to serve as a rapid reaction force, support special operations, strike behind enemy lines, and participating in peacekeeping and humanitarian actions. The Airborne Troops are structured and function in a manner quite similar to the Ground Forces, but they are capable of parachuting personnel and equipment from airplanes and helicopters. Due to air mobility requirements, VDV units have fewer personnel, and smaller and lighter vehicles and equipment than that Ground Forces units. The Airborne Troops report directly to the Russian General Staff, and consist of four divisions, four brigades, and supporting units (Grau & Bartles, 2017, pp. 359-361).

Application of Russian Structure to Study Categories

The description of the structure of the Russian military, and Armed Forces provided a starting point for the understanding and organization of Russian military map symbology and terms. At the most basic level, all symbols and terms were categorized in terms of environmental domains, such as land, sea, air, space, cyber, etc. In some cases, a symbol or term could encompass two domains, such as a ship-based antiaircraft system or an aircraft-based anti-ship missile. Another basic means of categorization was the use of the 'branch of service'. Symbols and terms were categorized by their respective branch of service. Often, a given symbol or term was categorized into two or more categories if appropriate. For instance, mortar companies can be found in the Ground Forces, as well as the Airborne Troops and Naval Infantry.

Many, but not all, of the symbols and terms could be classified based upon their command and control relationships. This information was important when determining the symbols and terms' hierarchical relationships and for sorting purposes. Perhaps the most useful categorization scheme discovered was the Russian system of functional organization. All terms and symbols were able to be categorized by this methodology and were occasionally classified under multiple functional areas if appropriate. This functional scheme of organization implied that certain functional areas such as signal (communications), maintenance, and material support (logistics), were common to all branches, a fact that was later confirmed when the data were categorized.

The aforementioned categorization schemes were found to be the most 'natural' ways of categorizing Russian military map symbology and terms. But to facilitate sorting and search of these symbols and terms, a few other categorization methods were also employed. These categorizations mostly concerned the physical appearance of the symbol, and were deemed necessary for symbol identification, including such aspects as the following: units and headquarters; vehicles; weapons and equipment; individuals; lines of demarcation; positions and locations; movement and deployment; fortifications and obstacles; and structures. Symbols and terms were also grouped into 'families' so symbols and terms with common themes could be queried together.

In addition, the Russian military map symbols and terms were also categorized according to US/NATO categorization schemes. The first such scheme is the War Fighting Function system, which divides military activities into six, distinct, yet interrelated categories: movement and maneuver, intelligence, fires, sustainment, mission

command, and protection. The second categorization scheme was derived from US Army Doctrine Reference Publication 1-02, *Terms and Military Symbols* (Department of the Army, 2018). This scheme uses the following classifications: units, individuals, and organizations; equipment; installations; activities; control measures; and tactical mission tasks. Although US/NATO categorization schemes proved to be not as well suited to categorizing Russian military map symbols and terms as the schemes derived for this study, as will be discussed in the following chapter. The use of these NATO categories was deemed necessary to ease searching and sorting; provide a frame of reference for those familiar with the US/NATO military symbology system; and allow for some means of comparison between the categories derived for this study and the US/NATO categories that were available, so measures of effectiveness could be evaluated.

In addition to the aforementioned categorization schemes, the symbols were also cross-referenced to any terms that are routinely embedded or associated with the symbol. The capturing of these relationships was essential, as it was the only way that this study could analyze the customary relationships between symbols and their associated terms. Understanding these relationships is also necessary if there is any intent to not just interpret Russian military map symbology, but also to employ it for one's own cartographic purposes.

This chapter provided a basic description of the structure of the Russian military, and through which has provided some basic categories to organize Russian military map symbols and terms. The remainder of the chapter will explain some of the basic 'grammar' of Russian military mapping system and show a few examples of Russian military symbols

in the context of the earlier provided structure. Although there were thousands of symbols and terms in the database developed for this study, this chapter's descriptions and examples should be sufficient for a basic understanding of the Russian military symbology system and how the database is structured.

Fundamentals

Commander's Working Map

Before an account of a system for the understanding and organization of Russian military map symbology and terms is described, there should be some explanation of the context that these terms and symbols are used in. The preponderance of Russian military terms and symbols is found in the commander's working maps. A commander's working map (CWM) is a topographic map on which a commander and chief of staff use to depict the current situation, plans for battle (on the offense or defense), task subordinates, and assist in understanding the situation as it develops, as shown in Figure 4.7.

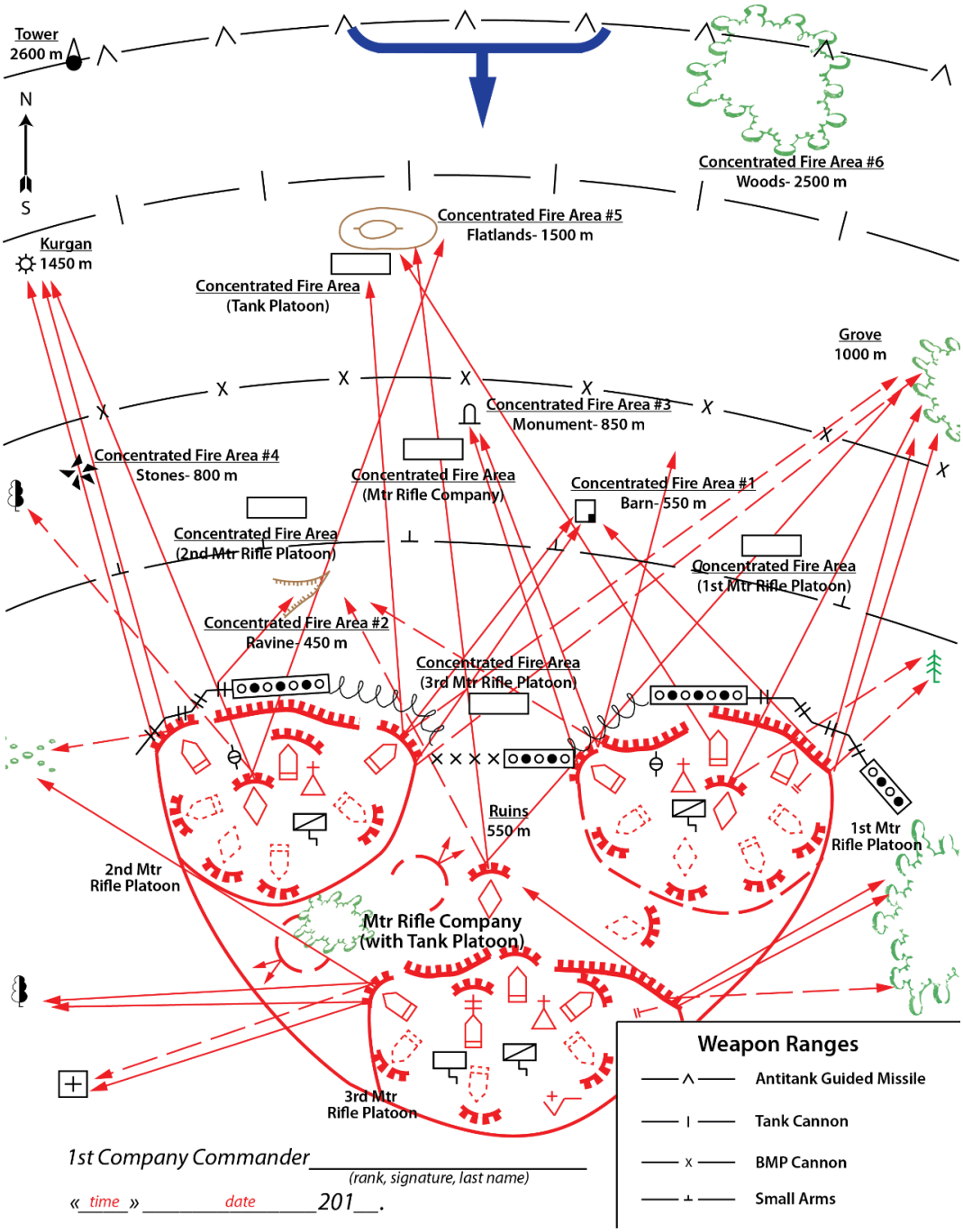


Figure 4.7. Example of a translated commander's working map. From *The Russian Way of War: Force Structure, Tactics, and Modernization of the Russian Ground Forces*. (p. 83), by L. W. Grau, and C. K. Bartles, 2017, Fort Leavenworth, KS: Foreign Military Studies Office. In the public domain.

The first step in creating these CWMs is that the commander views and understands the CWM of the immediate higher headquarters. Subordinate commanders use these CWMs to assist in understanding: taskings from higher headquarters, terrain, current dispositions of friendly and enemy forces, and the general situation. This data is used by the subordinate commander to develop his own CWM, which is in turn passed to his subordinates. CWMs are typically produced on map scales that are appropriate for the unit's area of operations. For example, 1:100,000 maps are used by division and brigade-sized elements, while 1:50,000 maps are used by battalion-level units (See Appendix B). In certain circumstances, such as during the conduct of operations in urban areas and water crossings, 1:25,000, or 1:10,000 maps may be used, if available (Pombrick & Shevchenko, 1972).

Topographic maps are provided to Russian units by their higher headquarters. Companies and platoons typically receive their maps from their respective battalion or the brigade, regiment, or division headquarters upon receiving orders to conduct a combat mission. The CWM must be maintained as completely and accurately as possible. This standard is defined by the scope of data necessary for the commander or chief of staff to provide adequate command and control of subordinate troops while in battle. Necessary data usually includes the following: position of subordinates and adjacent friendly forces; information about the enemy; the combat mission of the higher headquarters; the unit's combat mission (assigned by the higher headquarters); the combat missions of subordinate units; communications; information about the nuclear, chemical, and biological conditions; coordination procedures; the time and place of control points; the direction of movement of

the command post (during movement); and the locations of supporting rear area units. As a rule, data about the commander's subordinate troops are shown to a depth of two echelons. (For example, a brigade commander's CWM will depict the location of the subordinate battalion's companies) In the Soviet/Russian military system, the CWM is often the only document produced on the battlefield, and once it is signed it is considered an actual legal document, that must be adhered to by subordinates (Rodionov, et al., 2012).

The remainder of the chapter will outline the results of the application of a semiotic approach to Russian military map symbols and terms as they are applied to the commander's working maps. Although other types of maps use Russian military map symbols and terms, the rules for CWMs appear to govern them as well.

Positioning

Symbols designating the position, missions, and actions of troops, weapons, and equipment are drawn centered on their geographic location and oriented in the direction of action or firing. The military symbols and terms drawn on maps should not obscure any pertinent information, and so lines may be used to offset symbols if necessary (Andreev et al., 2006, p. 13).

Colors

Russian CWMs are typically prepared in one of two different marking schemes, monocolor, and color, as shown in Figure 4.8. If only one color is available, friendly symbols are drawn with thick lines, but enemy symbols are drawn with double thin lines. If colors are available, the color scheme is as follows: Red- the position of command posts; and the missions and actions of maneuver units such as motorized rifle and tank

units (except as noted), lines demarcation between different echelons of forces, rear borders, and nuclear strikes are marked in red. Black- the position and actions of units such as: artillery; anti-aircraft artillery; engineer; nuclear, chemical, and biological defense; signal; radio-technical; railway; road; pipeline troops; electronic warfare; signal intelligence; maintenance; airfield operations; topogeodetic; hydrometeorological; and construction are marked in black. Blue- the position and actions of enemy forces are marked in blue. Yellow- areas contaminated with toxic substances are marked in yellow. Green- False (deception) areas, lines, structures, and objects are marked in green. Brown- unit movement routes are marked in brown (Andreev et al., 2006, pp. 13-14). In situations where marking materials and/or geospatial information technologies are unavailable to produce colored markings, military map symbols may be drawn in a monocolored scheme. As shown in Figure 4.8, friendly units are drawn as normal, but with black lines, while enemy units are drawn with two narrow lines.

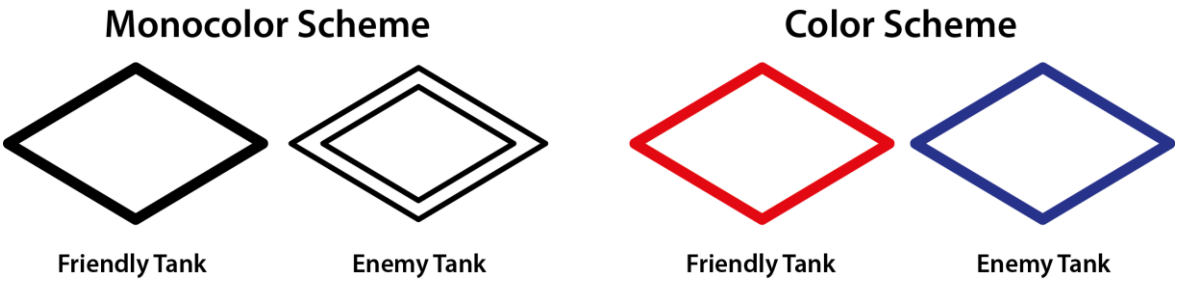


Figure 4.8. Scaling of Symbols Examples of monocolor and color marking schemes.

Russian military map symbols have three types of symbols based upon the attribute of scalability, as shown in Figure 4.9. Scalable symbols- are generally described features

that can be depicted in terms of areas or lines. The area and/or length can be adjusted to more accurately describe the phenomena on the map. Typical scalable symbols describe features such as: the positions of troops and area of their operations; firing positions of artillery units, lines of demarcation, trenches, areas and zones of artillery fire, nuclear strikes, and other features whose dimensions allow them to be depicted at scale. Russian symbols are shown in red for combat maneuver symbols or black for artillery and engineer symbols. Non-scalable symbols- are used to describe features that cannot be shown at map scale, such as individual vehicles, pieces of equipment, observation posts, etc. Non-scalable symbols are typically centered on their indicated position, with the exceptional features that are represented by flagpoles, in which case the base of the flagpole is centered on the indicated position. Combination symbols- Combination symbols are combinations of both scalable and non-scalable symbols, these symbols generally combine line and/or area features with point features. The line and/or area features a scale, but the point features do not. The unit names and nomenclatures for friendly troops are written in black, while enemy troops are depicted in blue (Psarev, 2005, pp. 44-45).

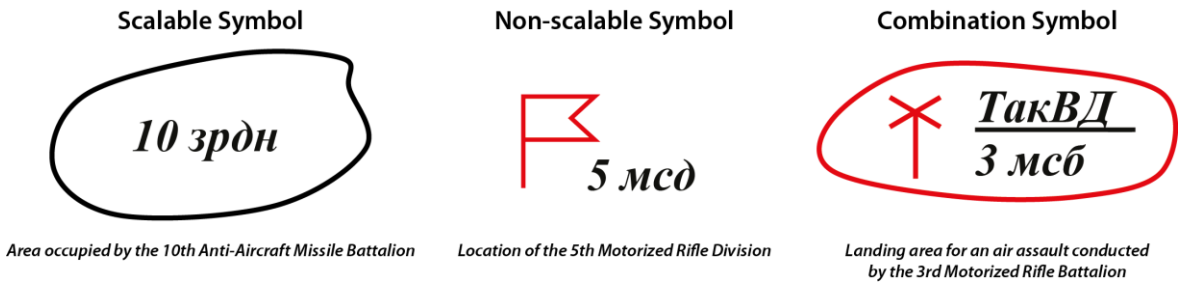


Figure 4.9. Examples of scalable, non-scalable, and combination military map symbols.

Basic Symbol Types

This section describes Russian military based upon their general appearance and purpose. This study has identified seven categories that the Russian military map symbols may be divided: units and headquarters; vehicles; individuals; lines of demarcation; positions and locations; movement and deployment; fortifications and obstacles; and structures. These categories are not native to the Russian system but are simply intended to assist with symbol identification. The following examples are just a small sample size of the approximately 1,000 military map symbols collected for this study but represent the categories well.

Units and Headquarters

Flag and Staff-Type Symbols

Unit locations on Russian maps are annotated in several ways, depending on the unit's size, if the unit is in motion and the purpose of the map. The first method is the use of "flag" and "subunit" symbols. Flag-type depicts units that are battalion size and above, as shown in Figure 4.10. Russians consider these units to be "whole" (*chast*) units. The "subunit" (*podrazdeleniye*) symbols resemble a telephone pole and are used to show the constituent subunits (companies, platoons, etc.) of whole units, as can be seen in Figure 4.11. Subunit symbols are used in conjunction with the vehicle, weapon systems, and other symbols to indicate unit size and type. Flag-type symbols may denote Ground Forces, Aerospace Forces, and Navy units.

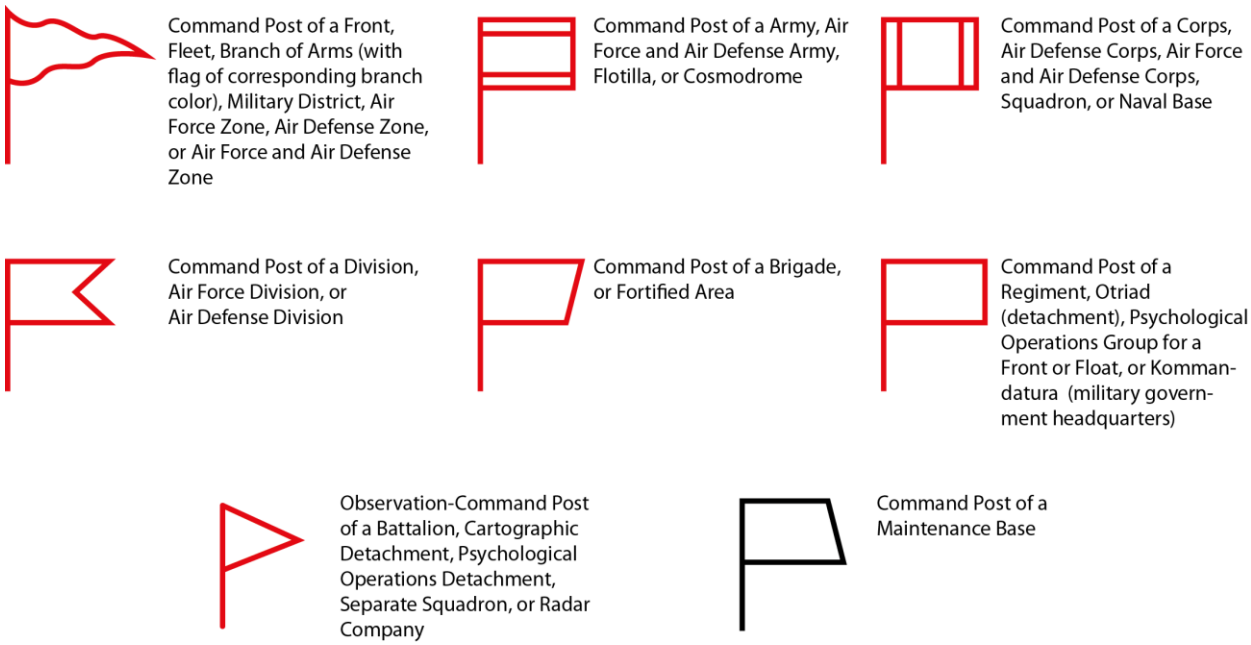


Figure 4.10. Examples of flag-type symbols.

Figure 4.11. Examples of staff-type symbols.

A battalion can be represented with either the flag or the telephone pole like symbol because it is a transitionary echelon between the smaller subunits and larger whole units. [Depending on the specific unit and the context, a battalion could be considered either a whole unit or subunit.] Flag and subunit symbols are used to indicate the size of a unit on small scale maps and may contain a circular area around the staff of the symbols to indicate the area the unit is occupying. On larger scale maps, the same symbol may be

used to annotate the exact position of the unit headquarters. A third use of the symbol is that it can be combined with other symbols to indicate the position of the commander, his vehicle, or a command and observation post belonging to the unit. The unit type and specific unit identifying information will usually be annotated with a Russian acronym to the side of, or inside of, the symbol.

Staff-Type Symbols Combined with Equipment Symbols

The second method of unit annotation combines a subunit symbol with an equipment symbol. For example, the platoon symbol combined with an armored personnel carrier symbol results in an armored personnel carrier platoon symbol, as shown in Figure 4.12. This method is used almost exclusively in large scale, tactical maps. The third method, which also employs staff-type symbols, is used in conjunction with equipment symbols to depict units in motion, as shown in Figure 4.13.

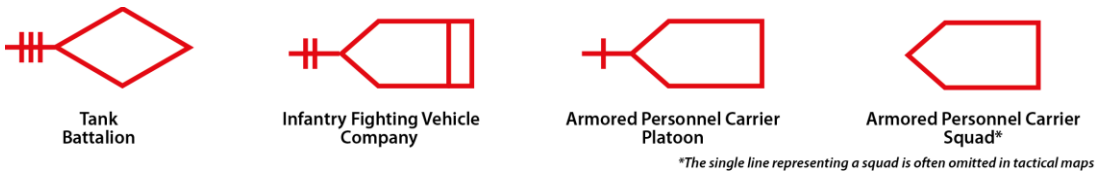


Figure 4.12. Examples of staff-type symbols in conjunction with equipment symbols.

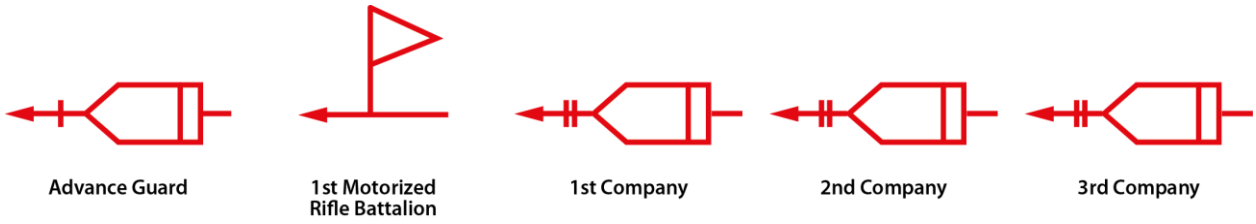


Figure 4.13. Examples of staff-type symbols depicting units in motion.

Task Organized Units

A third category of Russian unit symbols are task organized symbols. These symbols are used to denote when a unit, or group of units, has been ordered to perform a specific task. When task organization occurs the unit(s) are annotated with a different symbol denoting this task organization. For example, as shown in Figure 4.14, the symbol of a reconnaissance group can stand for a motorized rifle squad that is conducting reconnaissance.

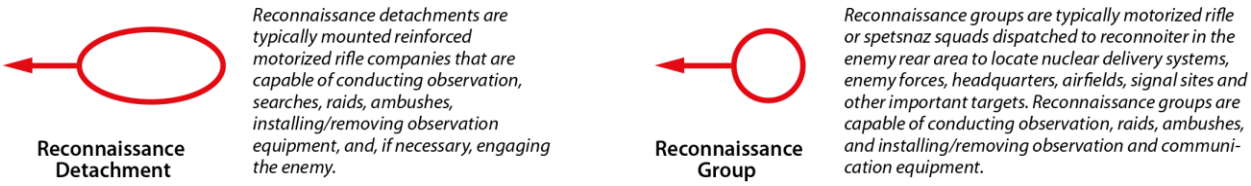


Figure 4.14. Example of a task organized units. Adapted from *The Russian Way of War: Force Structure, Tactics, and Modernization of the Russian Ground Forces.* (p. 275), by L. W. Grau, and C. K. Bartles, 2017, Fort Leavenworth, KS: Foreign Military Studies Office. In the public domain.

Vehicles

The Russian military symbology system has three basic ground vehicle types that serve as the basis for many symbols. These basic ground vehicle types can be modified to depict the vehicle has certain capabilities and may be combined with other symbols. For instance, the rhombus-like symbol in Figure 4.15., is the general symbol for a tank. But as can be seen in Figure 4.16., this symbol can be modified to not only depict tanks with different capabilities but also completely different vehicles based upon a heavy tracked chassis, such as a heavy tracked bridge-layer. As will be described in later sections,

planes, helicopters, and submarines follow similar conventions. Although there are three basic ground vehicle types, there are other symbols representing vehicles, but these three basic ground vehicle types are most common.

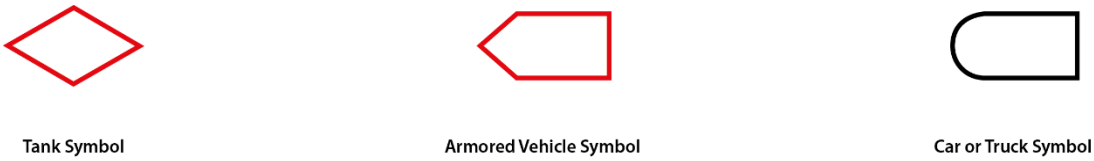


Figure 4.15. The three basic ground vehicle types.

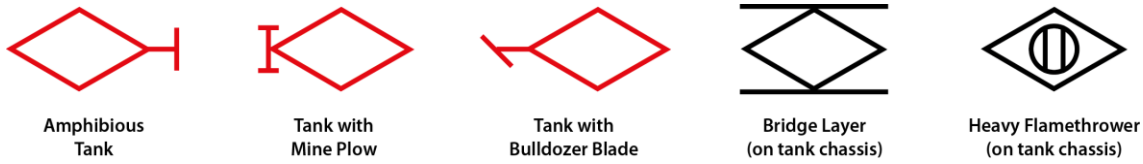


Figure 4.16. Examples of modifiers for the tank symbol.

It is important to note that just because a symbol lacks a given modifier does not necessarily mean that vehicle does not have that given capability. For instance, most Russian armored personnel carriers are amphibious, yet the propeller-like modifying symbol is rarely used. This is because these systems are assumed by Russians to be amphibious, and are usually only drawn if there is some reason to draw attention to this amphibious capability, such as perhaps depicting a water crossing. For similar reasons, symbols denoting radios are usually only shown for communications planning purposes, even though most Russian vehicles have radios.

A notable difference discovered between Russian and US/NATO symbology systems is the annotation if the vehicle has wheels or tracks. In the US/NATO system, the distinction between these two different types of chassis is considered to be very important. Wheeled vehicles are referred to as 'motorized', while tracked vehicles are referred to as 'mechanized', and each has a different US/NATO symbol. The Russian system makes no such distinction. Although the rhombus-like symbol always stands for a tank or other such vehicle on a heavy tracked chassis, the symbols for an armored personnel carrier and infantry fighting vehicle can stand for either a tracked or wheeled vehicle. If the exact vehicle type is known and deemed important enough on the map, the Russians simply annotate the vehicle's nomenclature next to the symbol.

Weapons and Equipment

Symbols for weapons and equipment are the most numerous of the basic symbol types, examples of which can be seen in Figure 4.17. Weapons systems typically have one symbol that generically describes the weapon system. These symbols may be modified to depict various weapon system capabilities. For example, in Figure 4.18., the general symbol for a field gun can be observed. This symbol can depict any field gun, or the symbol can be modified to depict the field gun's caliber, if known. [Often the general symbol is used because it is assumed the map reader knows what equipment the unit possesses.] This pattern of symbol development can be seen in many other Russian weapon systems and usually depict different calibers, range of missiles, and even nuclear munitions.

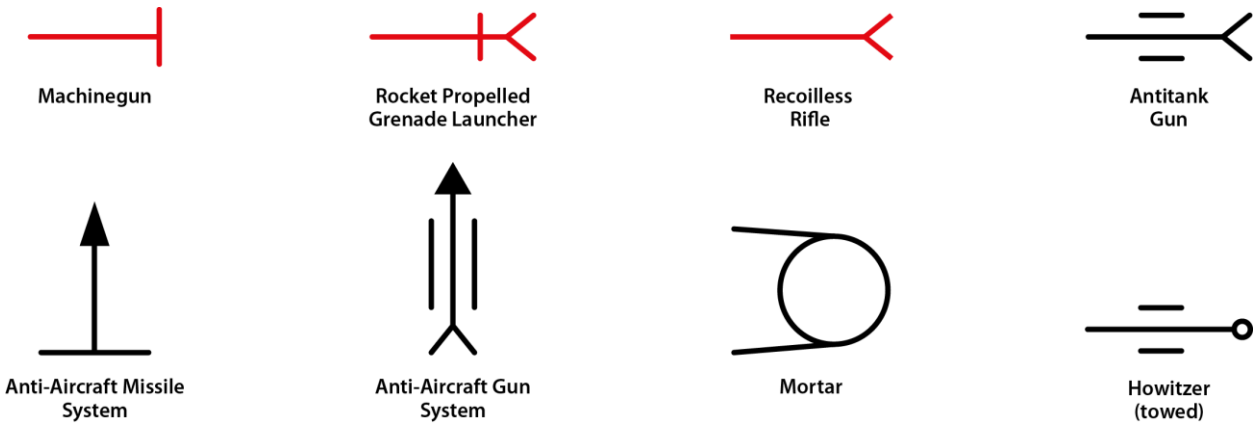


Figure 4.17. Example of weapon system symbols.

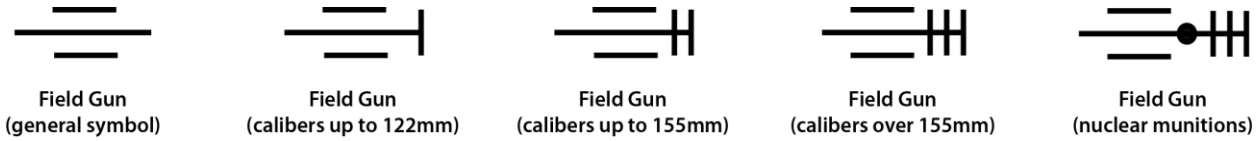


Figure 4.18. Example of symbol development for weapon systems.

Individuals

Almost all personnel in the Ground Forces, Airborne Troops, and Naval Infantry can be identified with a specific symbol. These symbols are used in manuals and training publications to indicate a specific individual's location in a parade formation and for training purposes. They are also used to indicate personnel dispositions on or around armored vehicles, and crew-served weapons. All personnel symbols consist of a red circle with a Russian acronym indicating the individual's role. These symbols may be combined with the before mentioned staff-type symbols to indicate at which echelon they serve (Taylor, 1978, p. 15). For instance, as seen in Figure 4.19., the only difference between the squad leader and the platoon leader's symbol is the staff structure indicating squad or

platoon. Figure 4.20., provides an example of these are employed for training purposes to describe how a dismounted motorized rifle squad should maneuver from a vertical column to a horizontal formation.

Figure 4.19. Example of symbols representing individuals.

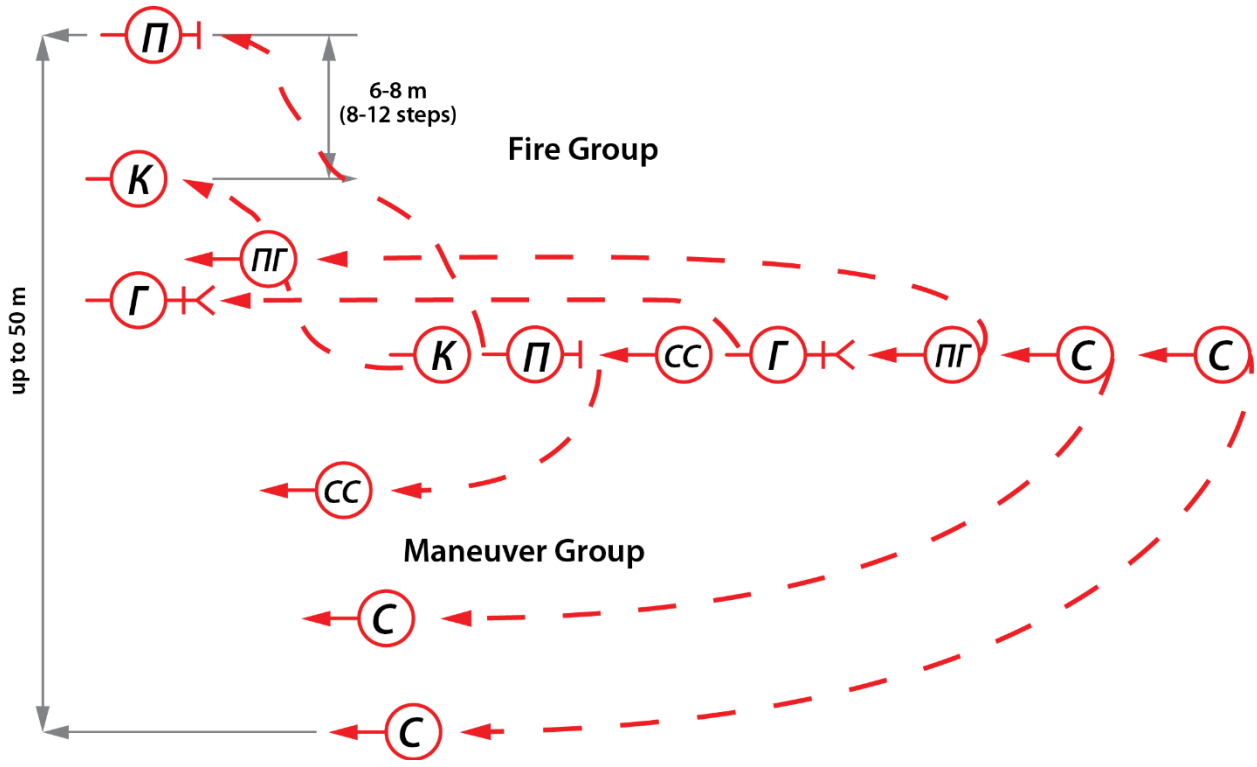


Figure 4.20. Example of a dismounted motorized rifle squad. From *The Russian Way of War: Force Structure, Tactics, and Modernization of the Russian Ground Forces.* (p. 110), by L. W. Grau, and C. K. Bartles, 2017, Fort Leavenworth, KS: Foreign Military Studies Office. In the public domain.

Lines of Demarcation

The Russian military uses a variety of lines of demarcation to annotate boundaries between various units and echelons in order to delimit areas of responsibility, as shown in Figure 4.21. Lines of demarcation are also used to display the ranges of various weapons systems on large scale maps. Another use of lines of demarcation includes the ranges of signals intelligence stations from their receivers.

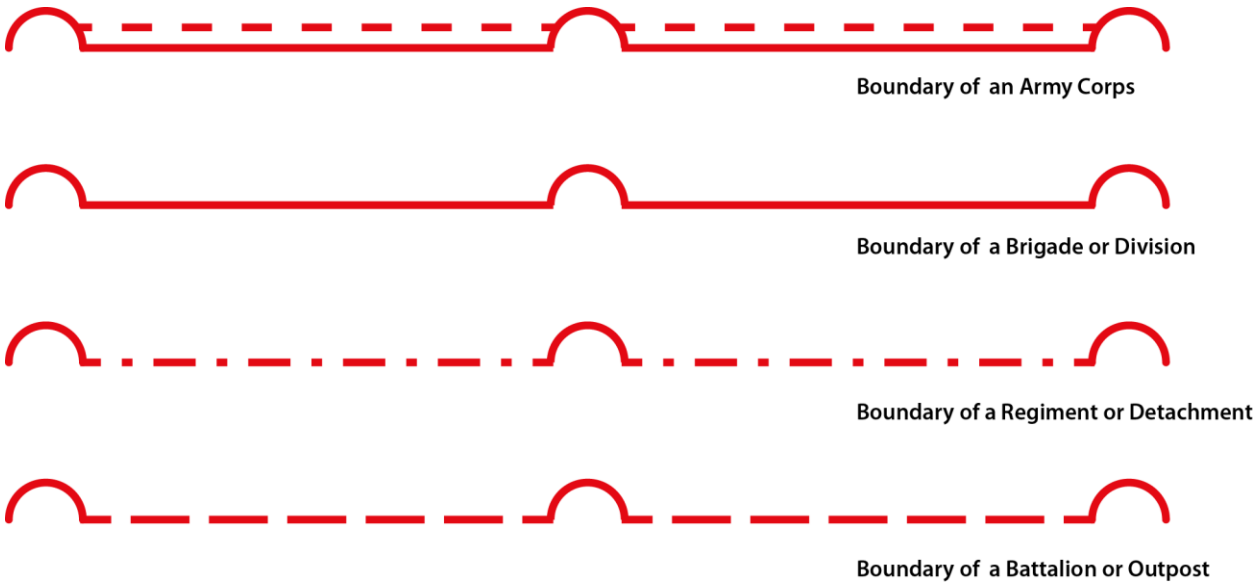
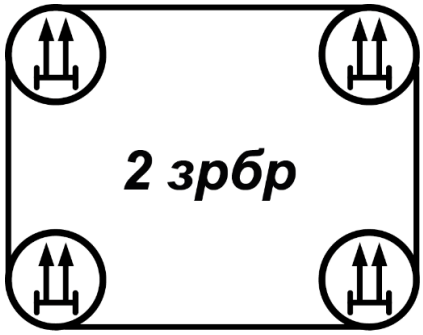


Figure 4.21. Examples of lines of demarcation.

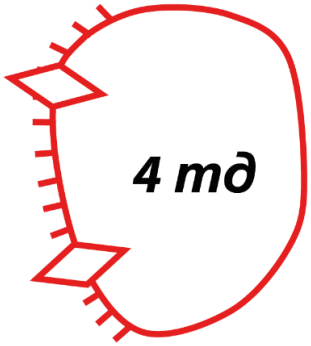
Positions and Locations

Symbols denoting positions and locations can show a variety of things including assembly areas, defensive and offensive positions, and areas contaminated by nuclear, biological, and/or chemical contaminants, as shown in Figure 4.22. Other commonly encountered such symbols include areas marking the firing positions of artillery and air

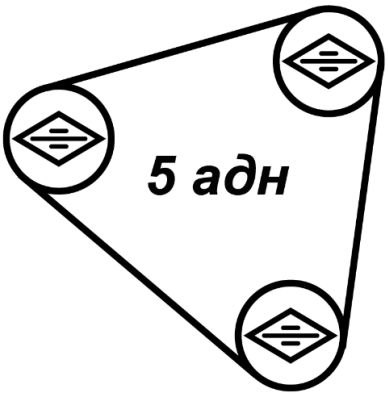
defense systems. Position and location symbols are almost always require a combination of other symbols, texts, and/or acronyms to convey the symbol's full meaning.



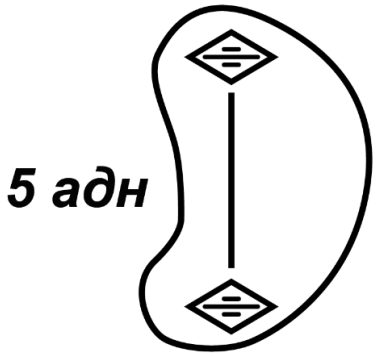
Firing area for the 2nd
Anti-Aircraft Missile Brigade



The 4th Tank Division in a defensive position



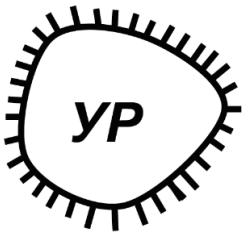
Firing area for the 5th Artillery Battalion



Firing area (hasty) for the 5th Artillery Battalion

The 2nd Airborne Division conducted an parachute assault, and occupied the area on 16 July, at 0520

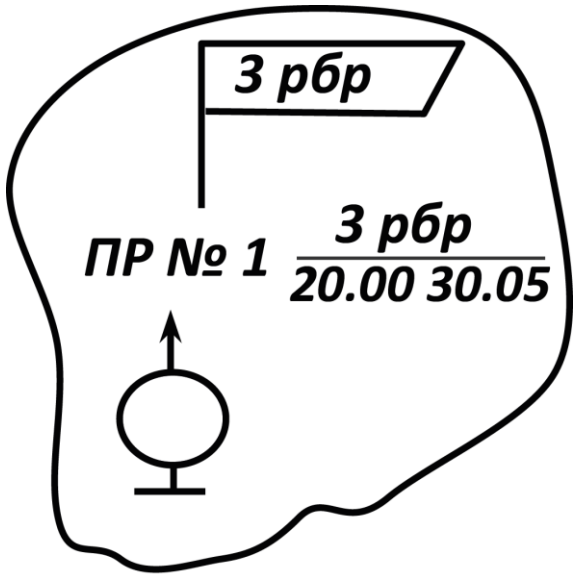
**Note the use of the 24-hour clock, this is the standard method of time annotation used by the Russian military*



Fortified Area

Figure 4.22. Examples of positions and locations.

As seen in Figure 4.23., the flag with the Russian term “3 рбр” means that the brigade headquarters is located at that position. The term “3 рбр” above the common structure for Russian military date time groups indicates that the 3rd Missile Brigade has occupied primary firing position № 1, and is ready to fire (as indicated by the symbol resembling a circle with an arrow pointing up) on 30 May, at 20:00. The irregular outline surrounding the graphics and textual elements indicate that the brigade’s subordinate units are located in this area. This example clearly shows the importance of a full understanding of all graphics, texts, and/or acronyms to accurately interpret a given symbol.



The 3rd Missile Brigade has occupied primary firing position № 1, and is ready to fire on 30 May, at 2000

Figure 4.23. Example of a complex location symbol.

Movement and Deployment

Movement

One of the most interesting differences discovered between the Russian and the US/NATO system of military symbology and terms was the propensity of the Russian military system to depict movement. Russian CWMs usually depict movement, while similar US/NATO maps rarely do so. [The US/NATO system usually shows action by way of multiple maps, with the action broken into discrete phases, with each map depicting a particular phase.] On small scale maps, movement is often simply depicted by the use of arrows, but on large scale maps, Russian officers employ several methods to show movement and/or future locations. As seen in Figure 4.24., these symbols can show when an advance begins, the direction of advance, successive dispositions of units, equipment, or personnel, and areas of responsibility. Although there are several methods of showing these aspects, they all typically involve the use of dashed lines to show successive positions.

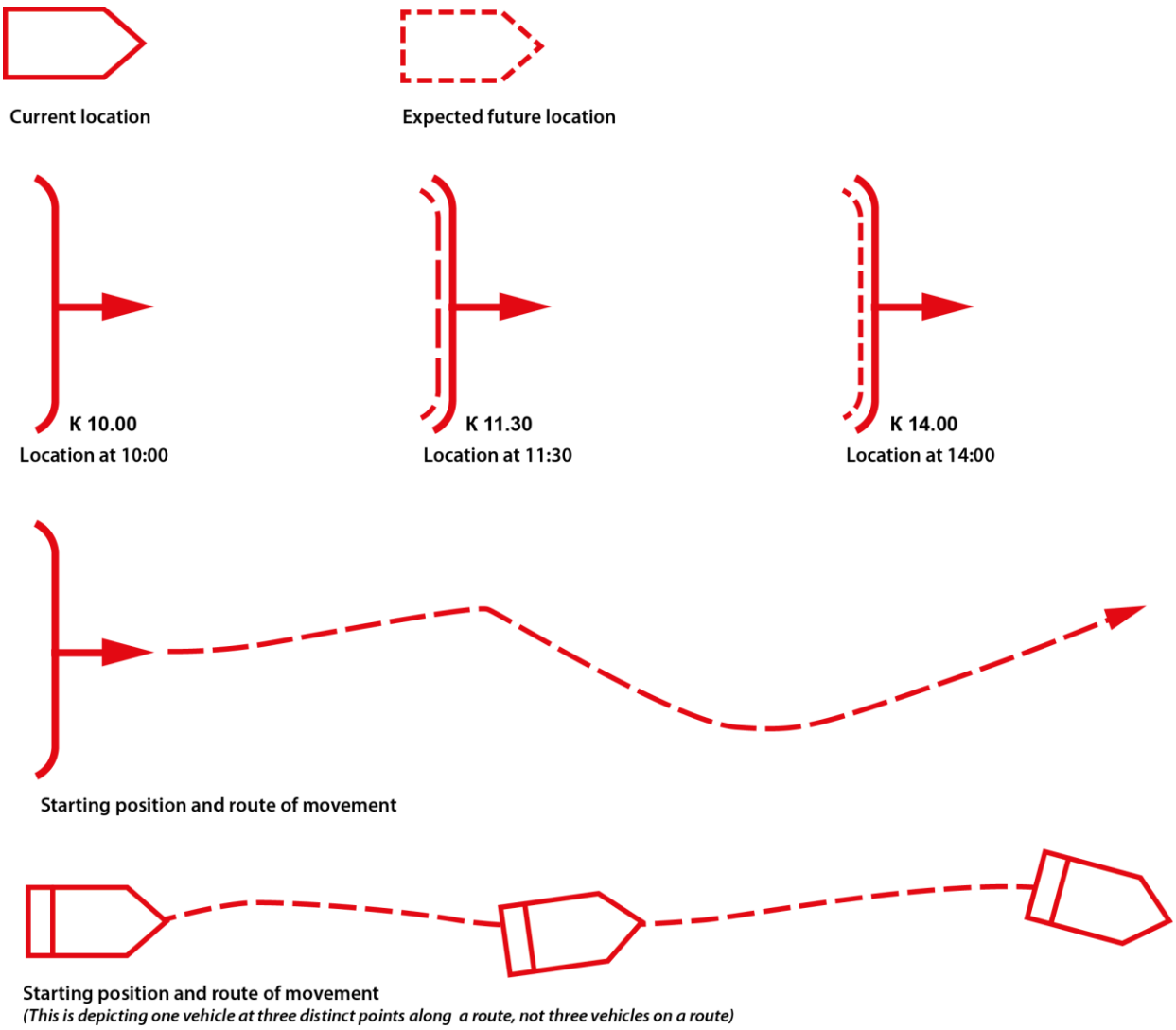


Figure 4.24. Examples of how movement is depicted on large scale maps.

Deployment

Units usually move in column formations, but when anticipating battle, units will typically transition from vertical columns (one after another) to a more horizontal formation (abreast of one another) to engage the enemy, as shown in Figure 4.25. For example, as explained in Figure 4.26., a battalion traveling in a column and planning to attack, will divide into

company columns, then into platoon columns, then into squad columns, and finally with troops spread out from one another throughout the breadth of the attack. This 'spreading' of units to conduct battle is a very important standard military practice, and so has distinct symbology to annotate the process.

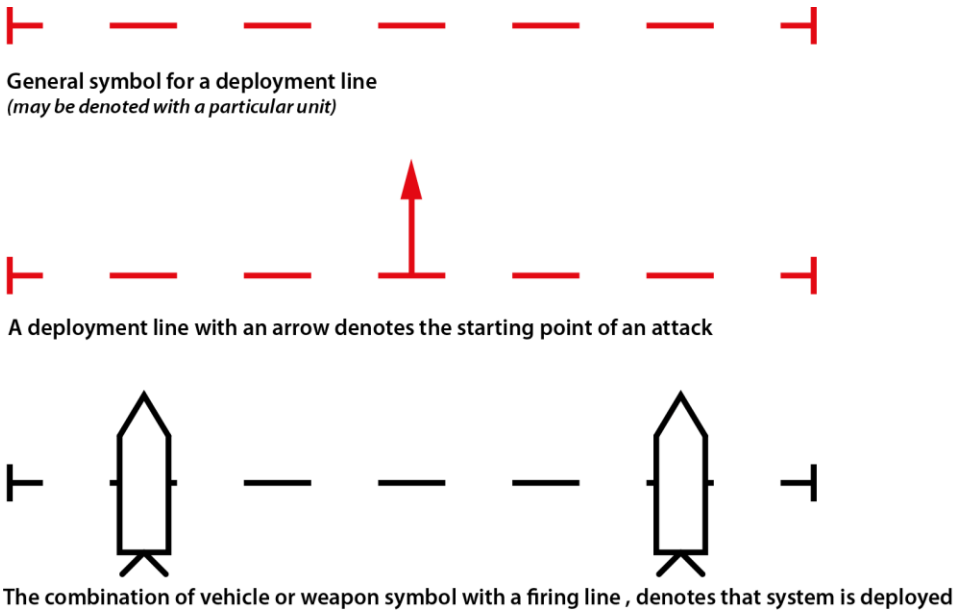


Figure 4.25. Examples of deployment lines.

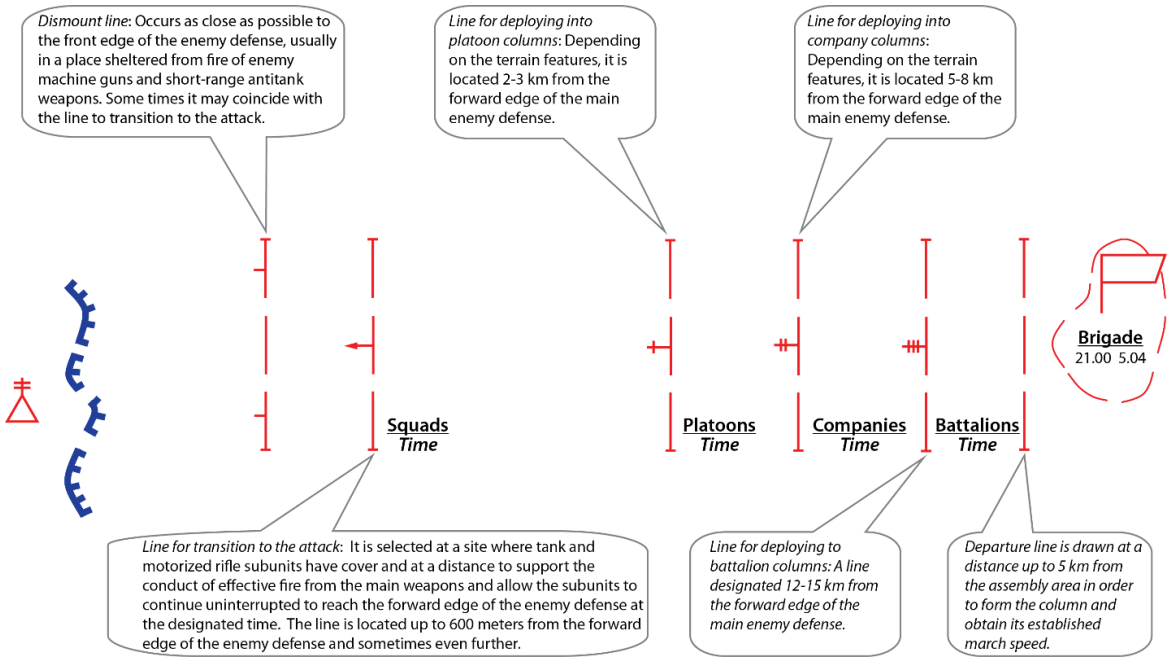


Figure 4.26. Example of deployment lines for a battalion conducting an attack. From *The Russian Way of War: Force Structure, Tactics, and Modernization of the Russian Ground Forces.* (p. 106), by L. W. Grau, and C. K. Bartles, 2017, Fort Leavenworth, KS: Foreign Military Studies Office. In the public domain.

Fortifications and Obstacles

Fortifications

In the Second World War, the Soviet Army gained a great deal of experience working with field fortifications. Although the maneuvering defense is the preferred method of defense, if a positional defense is used, and there is enough time to prepare, field fortifications will be constructed. These fortifications may resemble the lines of pillboxes and bunkers and bunkers of the First World War, or could be more permanent defenses made of earth, steel, and reinforced concrete. These symbols can represent fortified positions for personnel and crew-served weapons, defensive lines, shelters,

trenches, emplacements, and other such fortifications, as shown in Figure 4.27. (Taylor, 1978, p. 42).

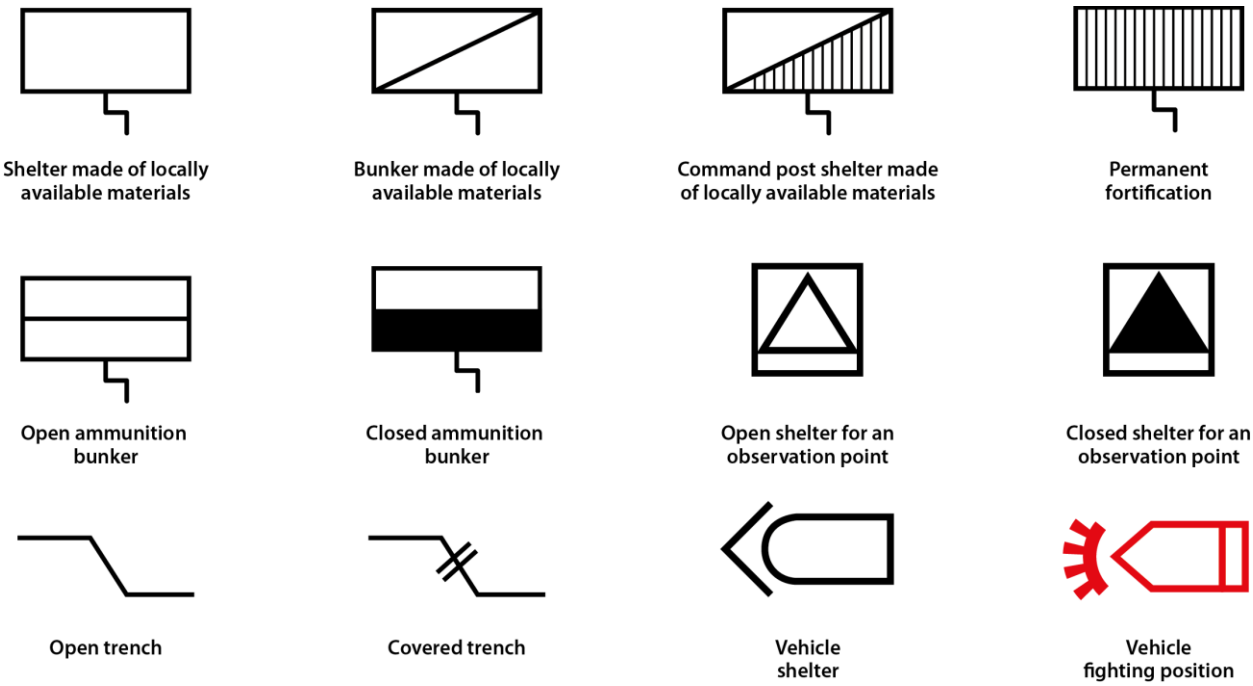


Figure 4.27. Examples of fortification symbols.

Obstacles

The Russian military uses a variety of manmade and natural obstacles to prevent or hinder movement. These manmade obstacles can include mines, barbed-wire entanglements, felled trees, ditches, barbed wire, and concrete and steel dragons' teeth. Natural obstacles can include ditches, berms, and escarpments of earth, ice, and/or snow, as shown in Figure 4.28. (Taylor, 1978, p. 45).

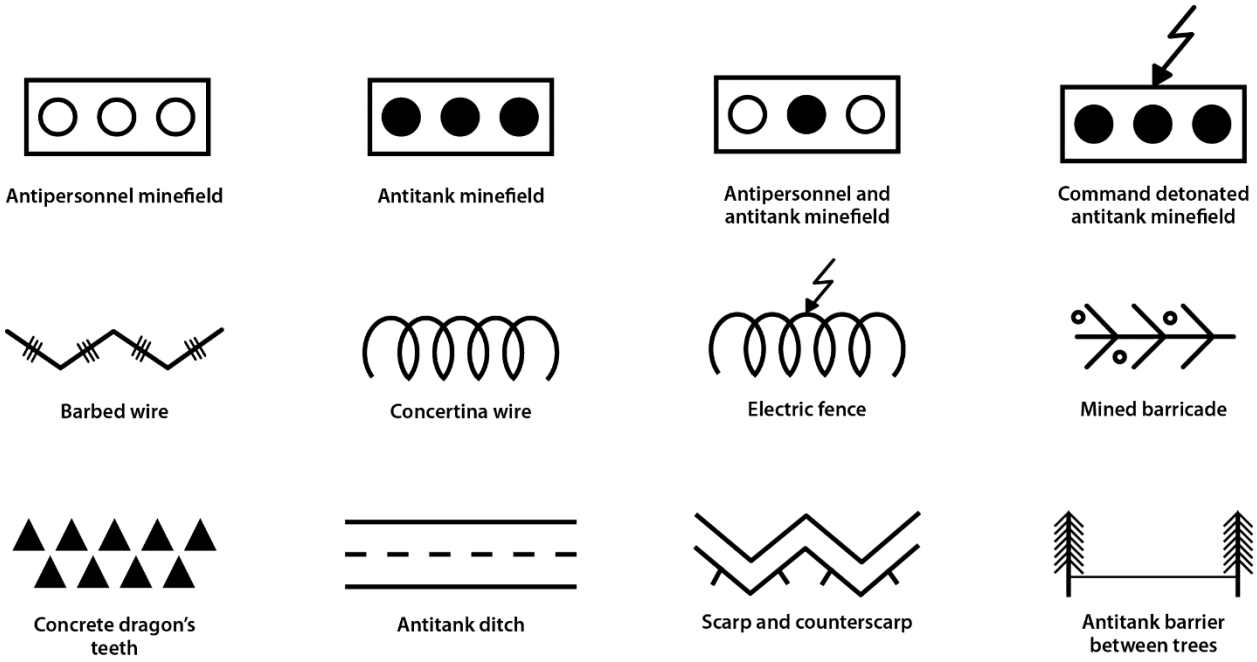


Figure 4.28. Examples of obstacle symbols.

Structures, Bases, Depots, and Military Industry

The annotation of structures and the urban landscape is a well-established part of Russian topography, the Soviets developed several schemes to annotate such futures at various scales (Military Topographical Directorate of the General Staff, 1983, pp. 3-14). Although these features are in the domain of traditional cartography, there are a few symbols, most likely to be found on small scale maps that are specifically for military use. These symbols usually describe structures for large military formations (armies, fronts, military districts) that are considered necessary for the type of large-scale industrial warfare that was characteristic of the Second World War. These structures include bases, depots, arsenals, factories, large hospitals, and such structures deemed necessary to support the national war effort, as shown in Figure 4.29.

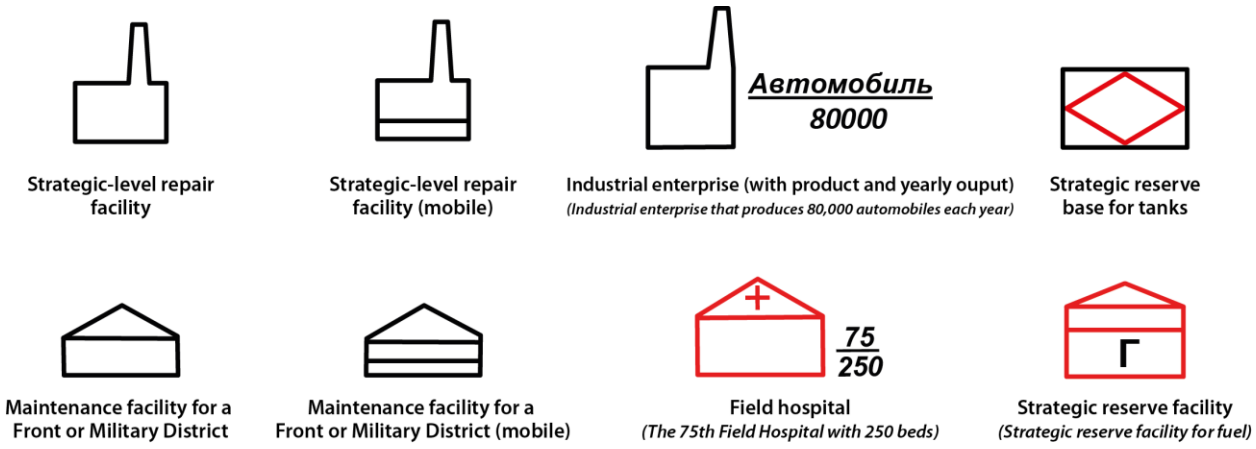


Figure 4.29. Examples of structures, bases, depots, and military industry symbols.

It is important to note that many of these symbols have modifiers to indicate that they can be permanent or mobile in nature. This abstraction is likely a consequence of the Soviet Union moving much of its industrial infrastructure across the Ural Mountains to protect it from the Nazis during the Second World War, and explains why these symbols may not be printed on topographic maps, as their presence may be fleeting.

Branch Specific Symbols

The preceding section has described Russian military based upon their general appearance and purpose. This section will provide examples of specific symbols for each branch of the Russian Armed Forces. As with the preceding section, these symbols are but a small sample, but indicative of the whole. This section, for the most part, parallels the functional structure of the Russian Armed Forces and does include examples of Russia's other military formations, namely the National Guard and Border Service.

Ground Forces Symbols

This chapter has already provided several examples of motorized rifle, tank, artillery, and air defense symbols, and so will examine some of the other symbols associated with the Ground Forces, as shown in Figure 4.30. One surprising result of this study was the large number of symbols concerned with the topic of water crossing, an engineer function. This study has identified over 150 symbols and terms related to the function of water crossing.

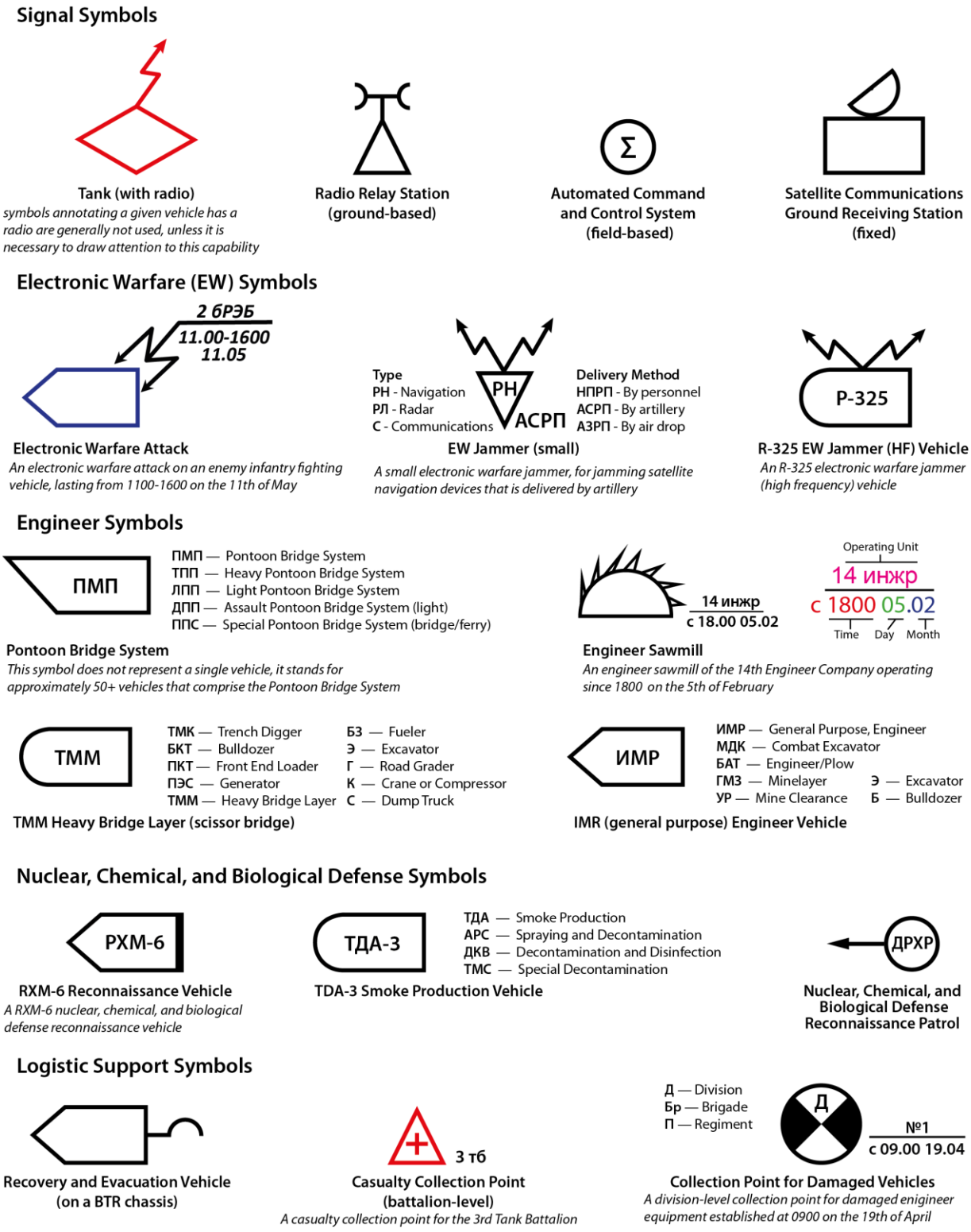


Figure 4.30. Examples of Ground Forces symbols.

The Russian military's interest in water crossing is well-founded. Since most of Russia's relief is relatively flat, Russia has many rivers that tend to be wide and relatively shallow. According to Vladimir Shamanov, the former commander of the Russian Airborne Forces, and current Chairman of the State Duma Committee for Defense, the Russian Federation has small rivers at 30-40 kilometer intervals, and average-sized rivers at 50-70 kilometer intervals (Krezul & Ramm, 2020). This terrain characteristic has led to the design of most Russian vehicles to either have some amphibious capability or to be able to ford water. Also, Russia has invested in several capabilities that can span large bodies of water, such as pontoon bridging systems. These types of bridging systems are very common in the Russian Ground Forces and can be found as company-level units in the maneuver brigades, and as battalion-level units in the army groups. These units are common in the Russian military, due to Russia being prone to flooding in the spring, with rivers occasionally spreading miles outside of their banks. These pontoon bridges may be used as standard bridges, or as large ferries to traverse particularly large bodies of water and are routinely used to restore civil infrastructure when flooding is particularly severe. Although the US and other NATO members do have pontoon bridging systems, due to the very different geographies and levels of infrastructure development of Western Europe and North America, US/NATO forces have far fewer pontoon bridging systems, than the Russian Federation. The US Army has no pontoon bridge systems in the active component, and instead relies upon 'scissor bridges', such as the Joint Assault Bridge System, that only spans about 11 meters. If the US Army needs more robust bridging

assets, they must be drawn from the reserve component, as only the reserve component possesses pontoon bridging units.

The Russian military's interest in water crossing, and pontoon bridges can be observed in the military map symbology, as can be seen in Figure 4.31. This study has found that topics such as: water crossings, artillery firing schemes, deception plans, etc., that have particularly well-developed symbols sets, are usually found to be exceptionally important to the Russian military. These water crossing symbols are also good examples of the importance of acronyms and abbreviations (textual data) for the interpretation of Russian military map symbols, without an understanding of this textual data, a complete interpretation of the symbol is not possible.

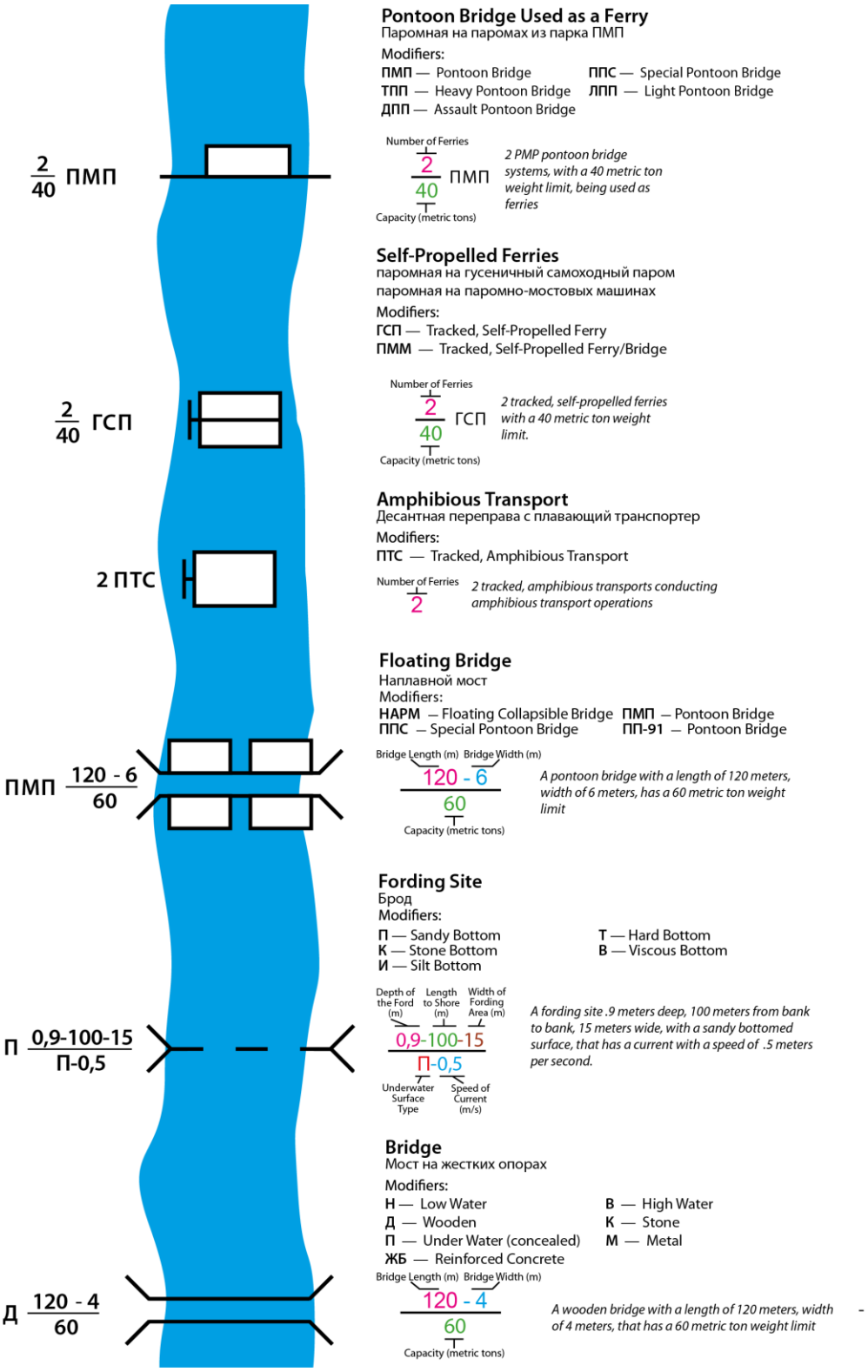


Figure 4.31. Examples of engineer water crossing symbols.

Aerospace Forces Symbols

The Aerospace Forces symbology is best described according to its three primary components, the Air Force, Air and Missile Defense Troops, and Space Troops. As the symbology for the Air and Missile Defense Troops is similar to the Ground Forces' air defense symbology, this section will focus on the symbology of the Air Force and Space Troops.

Russian Air Force symbology has five major vehicle types: planes, helicopters, dirigibles, aerostats, and unmanned aerial vehicles (UAVs). In the Russian Armed Forces, small UAVs may be found in the Ground Forces, Airborne Troops, and Naval Infantry, but large UAVs (requiring an airfield to take-off and land) are only found in the Russian Air Force. As seen in Figure 4.32., Russian plane symbols can be described in terms of range and function. Although all aerial vehicle symbols can be modified to describe the function, only the plane and UAV symbol are modified to describe range. Aside from aerial vehicle symbols, Russian Air Force has extensive symbology for the following: airports, airfields, and aerodromes; denoting aircraft attacks on ground targets; aerial battles; and ground support units.

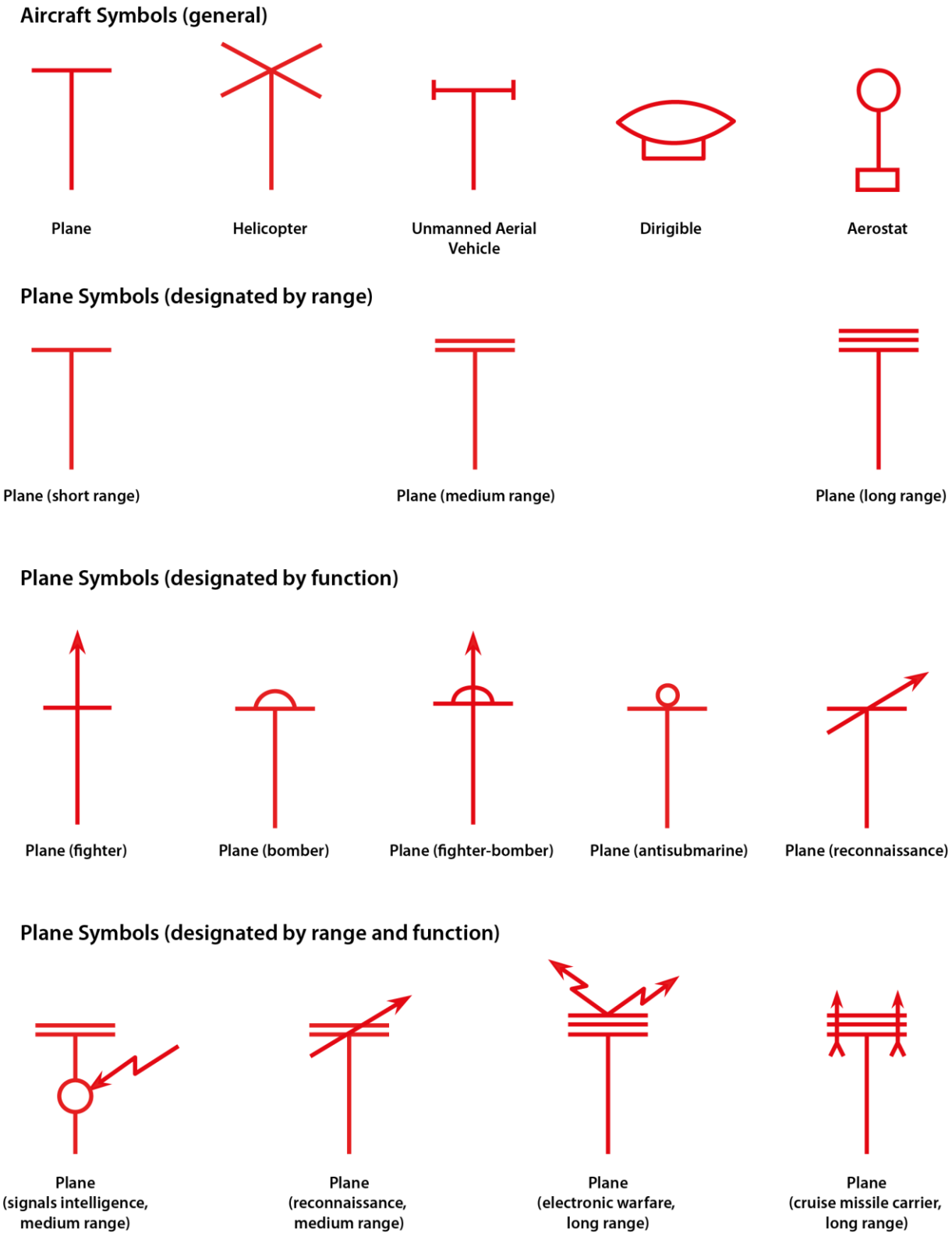


Figure 4.32. Examples of Air Force symbols.

The Russian Space Troops have three symbols that denote spacecraft: satellites, space ships, and space stations, as seen in Figure 4.33. The annotation of such spacecraft symbols on topographic maps is rarely encountered but could be used on topographic maps to denote their overhead locations, information which is important for counter-reconnaissance purposes. Although spacecraft symbols are important, the most commonly encountered Space Troops symbols denote the ground-based infrastructure essential for effective space operations. This ground-based infrastructure includes: spacecraft launch and landing sites; electro-optical and radar telescopes, for space object surveillance and identification (SOSI) purposes; ground receiving station, for the downloading of data; and command and telemetry command posts for the monitoring and command and control of satellites. Due to the technical nature of space observation technologies such as over-the-horizon radars, some of these assets also support air and missile defense missions, hence these symbols have been cross-referenced as also being air defense systems.

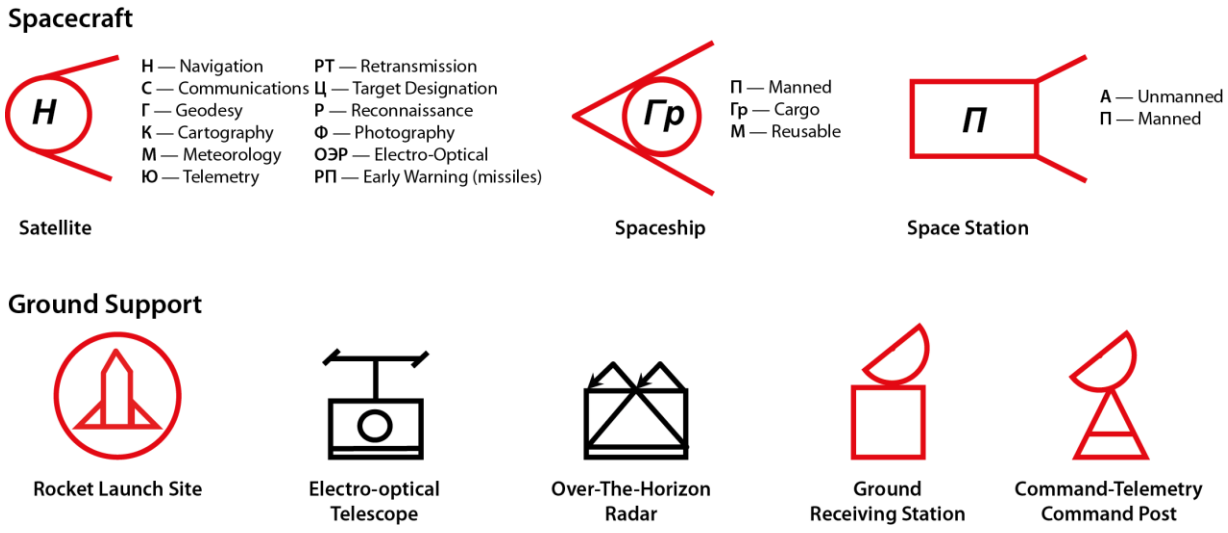


Figure 4.33. Examples of Space Troop symbols.

Navy Symbols

Russian Navy symbology has six major vehicle types: surface vessels, submarines, cutters, transports, barges, and floating docks. Surface vessel and submarine symbols may be modified to indicate displacement and/or function, as seen in Figure 4.34. Aside from naval vessel symbols, other Russian Navy symbols include bases, weapons (torpedoes, depth charges, cruise missiles, mines, etc.), and naval aviation. Since the Russian Navy is responsible for coastal defense, Russian Navy symbology also includes symbols for the Coastal Defense Troops, consisting of the Naval Infantry and Coastal Defense Artillery. As there are few differences between Ground Forces and Naval Infantry symbols, they require no further explanation, but the symbology of the Coastal Defense Artillery is substantially different than the aforementioned Ground Forces' artillery symbols, as seen in Figure 4.34.

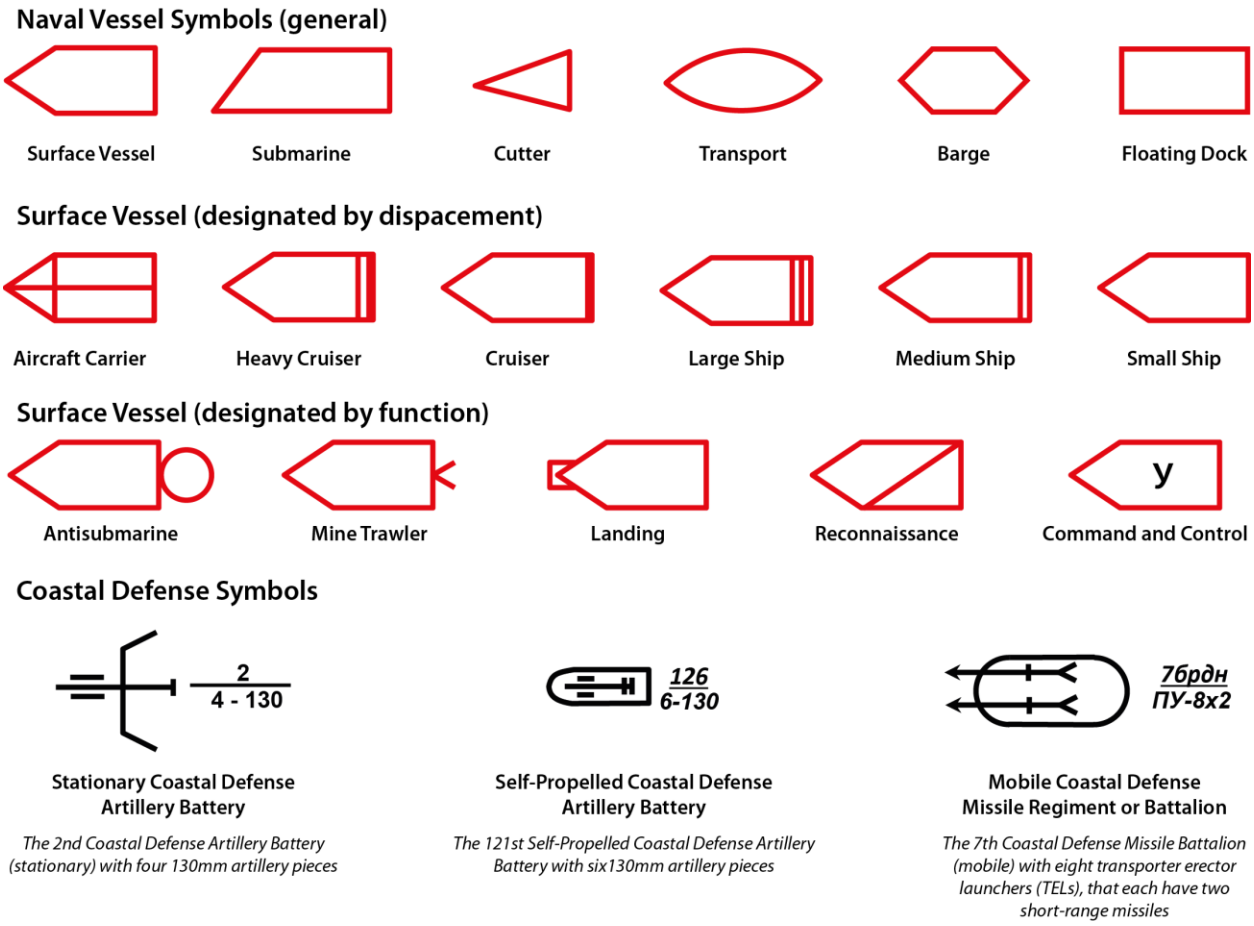


Figure 4.34. Examples of Navy symbols.

Strategic Rocket Forces Symbols

The Strategic Rocket Forces use many of the same symbols as the Ground Forces for signal, electronic warfare, engineer, and radiation, chemical and biological defense functions, but has a distinct symbol set for strategic rockets, strategic rocket launchers, and strategic rocket units as seen in Figure 4.35. A notable aspect of Strategic Rocket Forces symbols is that current Russian symbology documents display rail-based strategic rocket

launch devices, a system that is not presently not in inventory.[7] This system may be displayed for historical reasons or due to current Russian plans to field another such rail-based strategic rocket launcher (Ivashov, 2016).

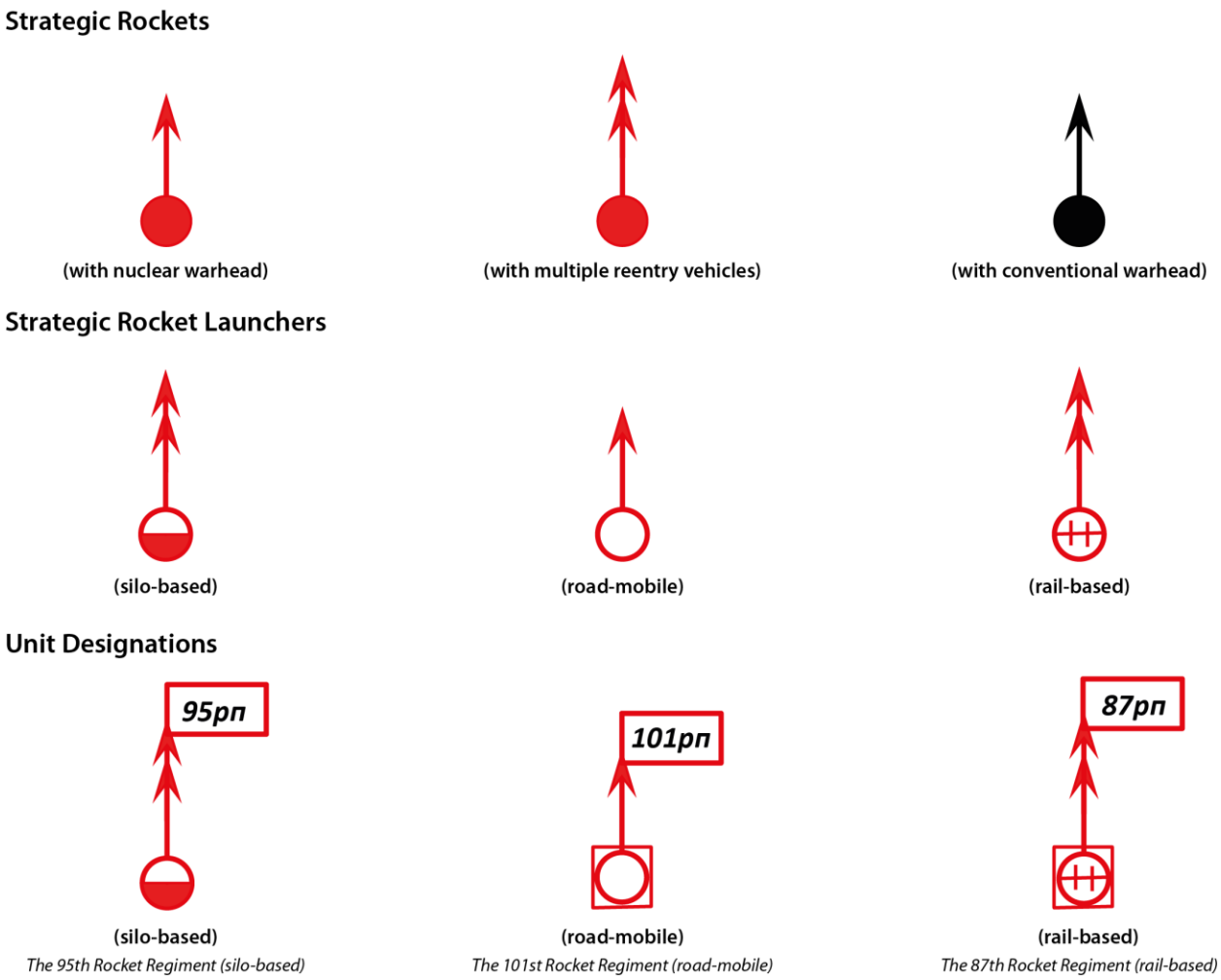


Figure 4.35. Examples of Strategic Rocket Forces symbols.

[7] The Soviet Union started using rail-based strategic rockets in 1985, and had three rail-based strategic rocket divisions (12 trains each, with three Molodets ICBMs) in Kostroma, Perm, and Krasnoyarsk. The Russian Federation eventually abandoned the program in 1993 due to the START II treaty, but even after its withdrawal from the treaty in 2002, it destroyed of almost all of its rail-based ICBMs from 2003-2007, except for two demilitarized trains that are on display in Russian museums (Gavrilov, 2014).

Other Symbols of Note

Jacques Bertin (1983) posited that cartographic representations do not just merely reflect reality but could in fact reveal new knowledge about the phenomena that they represent. For this reason, the following groups of symbols are of particular interest, as they have no US/NATO equivalents, due to differing roles that the Russian and US/NATO militaries fulfill within their respective societies. These different roles have led to the Russians employing different types of institutions that are generally unfamiliar to those in the West. Although may not be possible to directly study these institutions, some knowledge about them may be inferred through the study of the military map symbols used to represent their presence and activities.

Material-Technical Support of the Armed Forces Symbols

In the Russian Armed Forces, Material-Technical Support of the Armed Forces (*Material'no-tekhnicheskoye obespecheniye Vooruzhonnykh sil*) is a unified system of command and control bodies, institutions, and other military organizations that provide technical and logistical support for the Russian Armed Forces. This venerable institution's roots can be traced to the reign of Peter the Great, having undergone several name changes since its inception. Most recently, during the Russian Armed Forces' 2009 'New Look' reforms, the predecessor organization, the Rear Services, was disbanded, and the Material-Technical Support of the Armed Forces was created by merging most high-level maintenance and logistical functions into a single organization. This organization is responsible for planning and coordinating the provisioning of troops with armaments, equipment, ammunition, fuel, food, and any other needed supplies (Ministry of Defense of

the Russian Federation, n.d.). This organization is somewhat unique as it is not considered a 'command', but instead as a 'central staff organization'. Although it has entities that directly report to it, it also has elements in each branch of service. The Material-Technical Support of the Armed Forces coordinates with these entities but does not directly control them. For example, the Material-Technical Support of the Ground Forces, reports directly to the Ground Forces, but, in theory, it also coordinates with the Material-Technical Support of the Armed Forces (Altunin, 2012). Given the high-level nature of Material-Technical Support of the Armed Forces' maintenance and logistical responsibilities, its associated symbols are typically related to large maintenance depots and facilities, as seen in Figure 4.36. One particularly interesting symbol, in Figure 4.36., is a military farm. Military farming is the practice of military units growing crops and raising livestock to meet the unit's food needs. This institution has been in use in Russia since the time of Peter the Great. Since Western militaries do not employ military farms, although several have in the past, there is no US/NATO equivalent for this symbol (Donnelly, 1988, p. 190).

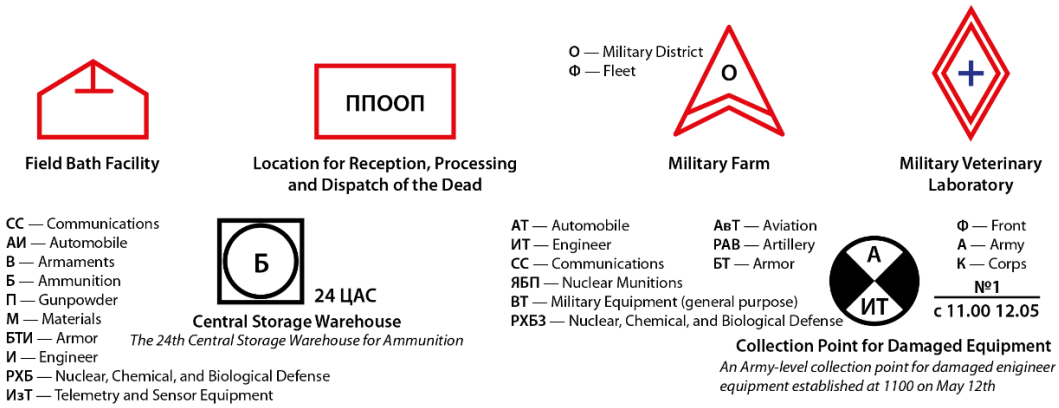


Figure 4.36. Examples of Material-Technical Support of the Ministry of Defense symbols.

National Guard Symbols

Due to fears of a coup, the Soviet Union chose to divest military power into several different government ministries and agencies. In today's Russian Federation, concerns about coups have significantly diminished, so there are ongoing efforts to consolidate military power into just a few ministries to reduce the bureaucracy and other redundancies. The creation of the National Guard (*Rosgvardiya*), which combined the Internal Troops (VV) of the Ministry of Internal Affairs, Special Rapid Response Detachments (SOBR), the Special Purpose Police Units (OMON) was one result of this reform. As the National Guard is structured along the same lines as the Ground Forces and possesses similar capabilities such as motorized rifle troops, tanks, artillery, etc.), it uses mostly Russian Ground Forces symbology. Since the National Guard does have an internal security focus, it does have a few specialized symbols for this purpose as seen in Figure 4.37.

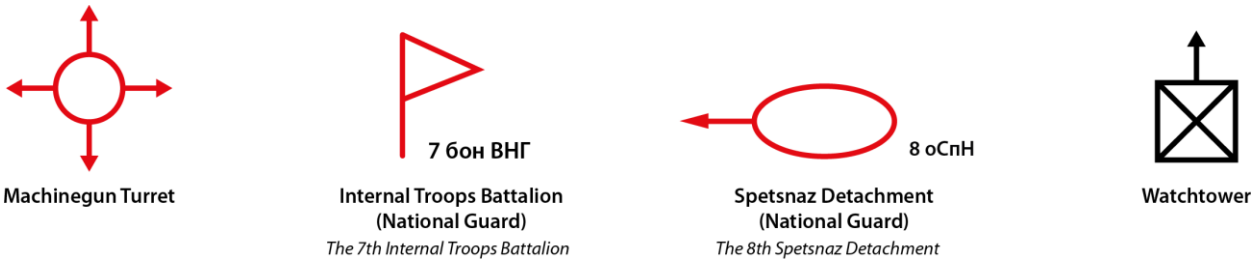


Figure 4.37. Examples of National Guard symbols.

The Border Service of the Federal Security Service of the Russian Federation [*Pogranichnaya sluzhba Federal'noy sluzhby bezopasnosti Rossiyskoy Federatsii*], or Border Service, are responsible not only for the protection of Russia's borders, but have,

and still are, used for border security in states that are close Russian allies. The Border Service was deployed to Afghanistan during the Soviet-Afghan War, served in Tajikistan on the Tajik-Afghan border from 1992-2005, and is currently serving in Armenia and Abkhazia. Due to their focus on border security, the Border Service has a unique organizational structure, and is organized into 8 regional and 36 district commands (Pogranichnaya sluzhba Federal'noy sluzhby bezopasnosti Rossiyskoy Federatsii [The Border Service of the Federal Security Service of the Russian Federation], n.d.). As seen in Figure 4.38., the Border Service has specialized symbols for annotating this command and control structure and other aspects relating to border security and travel across international borders.

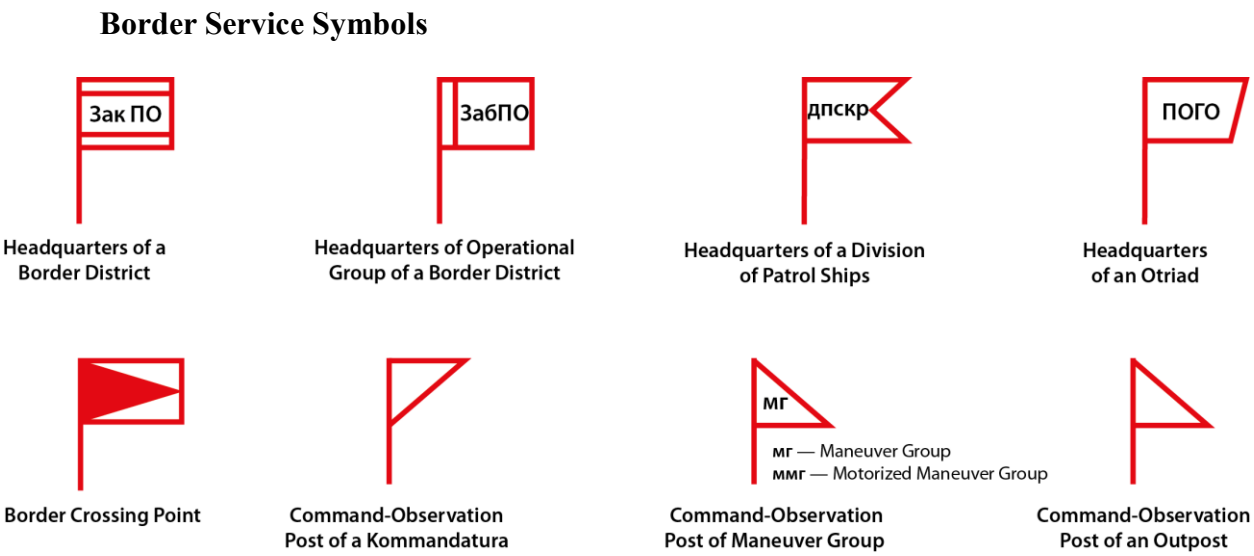


Figure 4.38. Examples of Border Service symbols

Military Commissariat Symbols

In Soviet times, the Soviet Union's plan to conduct large-scale protracted war involved keeping most units at a peacetime strength of 15-50% of authorized personnel and relying upon mobilized reservists to bring the units up to a minimum of 65% of authorized strength before the unit was considered operational. The responsibility for providing these reservists and males for the biannual (spring/fall) draft resided and still resides, with the Military Commissariats. These Military Commissariats are managed at the military district-level, having elements at the regional and local levels of government. Aside from running draft boards and managing reservists, the Military Commissariats are also responsible for maintaining records of militarily valuable resources for the communities in which they serve. In the event of large-scale warfare, Military Commissariats coordinate the local and regional support of Russian military forces in their respective areas. In addition, the Military Commissariats' records would be used to conscript local firms and commandeer civil property (such as trucks, construction equipment, food stocks, etc.) to support the war effort (Donnelly, 1988, pp. 156-158). This high-degree of civil involvement in the country's warfighting is reflected in Russian military map symbology, as seen in Figure 4.39.

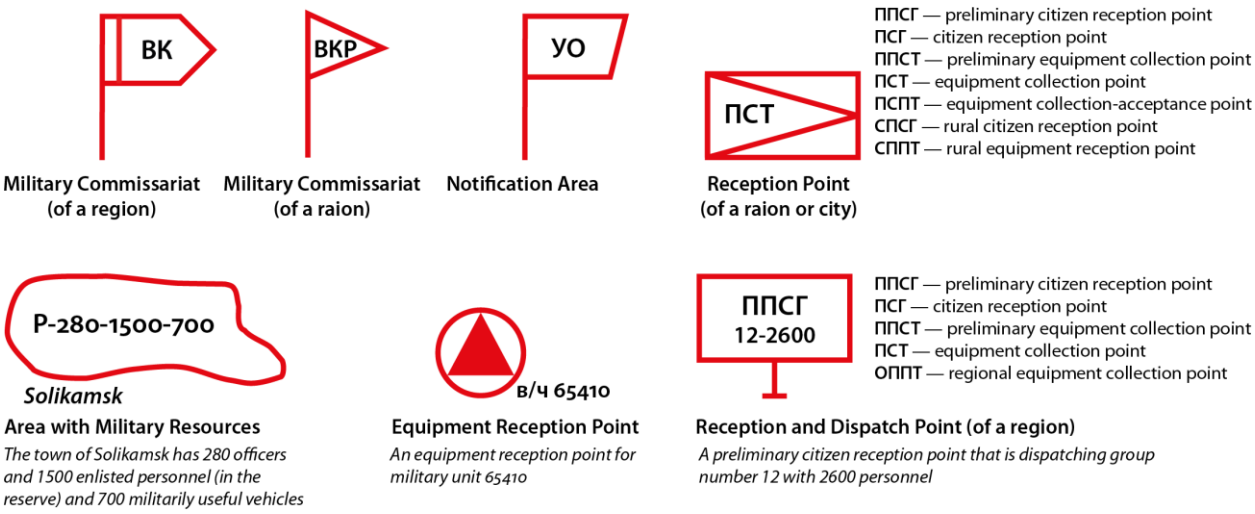


Figure 4.39. Examples of Military Commissariat symbols

Terms

The categorization of terms was conducted in the same manner as the categorization of the symbols. Each term was categorized based upon the branch of service, function, descriptive traits, warfighting function, and warfighting domain. The only significant difference that the fields "adjectives," "proper name," and "part of a proper name" were added to the "descriptive traits" category. One problem encountered during this study was the translation of the terms. In most instances a word-for-word translation from Russian to English was sufficient, but different approaches were required. On occasion, dictionary translations of terms varied from their intended meaning, a situation that occurs when a term has a different meaning in a military context. In these cases, the term was translated as closely as possible to the intended meaning as possible.

A more difficult problem encountered, were terms that have no equivalent meaning in English. For instance, the term 'maneuver defense' [*manovrennaya oborona*] is often

translated into English as ‘mobile defense’, a somewhat common US/NATO military term defined as a “defensive task that concentrates on the destruction or defeat of the enemy through a decisive attack by a striking force” (Department of the Army, 2019, pp. 4-3). This definition is significantly different than the Russian concept of ‘maneuver defense’, which is defined as “one of the main types of defense used to disrupt the enemy's offensive, inflict losses, protect important assets, and preserve combat power during the course of maneuver and positional defensive actions” (Tyutyunnikov, 2018, p. 151). The US term refers to the conduct of a decisive counterattack, while the Russian term means the trading territory in exchange for depleting the enemy’s combat power. Since the term ‘maneuver defense’ is not a standard US/NATO term, simply translating the term does not suffice. In these situations, the definition of the term is also required. To further complicate the matter, in some cases there were multiple definitions of a given term that were dependent upon the context, in these situations, the most commonly used term was used.

Summary of Results

In all, this study collected, translated, and categorized over 3,000 Russian military terms and 1,000 Russian military symbols into nine categories: hierarchal structure, functional structure, service affiliation, general description (derived for this study), warfighting domain, general description (derived from the US Army doctrinal publications), warfighting function (a common category used by the US/NATO militaries), general symbol appearance, and family grouping. In addition, symbols and terms were cross-referenced to one another so associated symbols or terms could be queried. Even

though none of these categories can be objectively described as being the "best" way of categorizing Russian military symbols and terms, the categories used for US doctrinal purposes were generally found not to be as good of 'fits' for the study, as the other categories, a topic that will be discussed further in the following chapter. Although these US categories were not particularly good 'fits' for the data, they did prove useful for sorting and comparison purposes. The categories that most adequately 'fit' the data were the categories that were 'structurally similar' to the military that the data represents — the categories of hierarchal and functional structure. This study found that since the relative 'value' of a given category depends upon the needs of the interpreter, multiple categories were required. And that the categories themselves were not just important, but the process of categorization and organization itself could reveal otherwise hidden knowledge about the phenomena that the terms and symbols represent.

This chapter described the results of applying a cartosemiotic methodology for understanding and organizing Russian military map symbols and terms. Since a semiotic approach suggests that the best way to accomplish this goal is through mirroring the abstract (symbols and terms) upon the abstracted (the military that the symbols and terms represent), this study has first translated approximately 1000 military symbols and 3000 military terms and then categorized them by way of the Russian military's hierarchical and functional organization. Although these Russian-derived categories were the most 'natural' way of categorizing Russian military map symbology and terms, this study has also employed a few categorizations for the sole purpose of sorting and searching, including the use of 'family' groupings, so symbols and terms with common themes could

be queried together. These 'sorting and searching' categories were deemed important due to the amount of data, which would otherwise be difficult to query in a reasonable amount of time. This study also used a few US/NATO categorization schemes. These categorizations also supported searching and sorting, but their primary value was that they helped facilitate understanding for those familiar with the US/NATO military system, and provided a means of comparison for the categories derived for this study.

CHAPTER 5

DISCUSSION AND CONCLUSION

"The philosophers have only *interpreted* the world in various ways; the point is to *change* it"

— Karl Marx, *Eleven Theses on Feuerbach*, 1845

Russian military map symbology and terms have sprung from long Russian military and cartographic traditions. This system was likely first codified during the interwar period to harness the power of new Soviet high-quality and large-scale maps and to accommodate the rapid military technological advances of the time. Unlike Russian topographic maps, which have well-documented symbology systems, that have been translated and analyzed, and are well-understood in the West — Russia's system of military map symbology and terms is much more decentralized and has received comparatively little attention in the West. This is because commonly used military symbols, terms, and acronyms are disseminated by the Russian General Staff, but specialty symbols, terms, and acronyms are developed by their respective communities in the Russian Armed Forces. Therefore, to grasp the entire system of Russian military map symbology and terms, one must look at a variety of sources including military manuals and regulations, training materials, military journals, and maps.

This study proposed an approach for the understanding and organization of Russian military map symbology and terms, grounded in European structuralism and based upon semiotics — an interdisciplinary method to attaining knowledge and problem solving, rooted in the social sciences. This was accomplished by use of the philosophical tradition of pragmatism, abductive reasoning, and the general theory of semiotics developed by

Charles Sanders Peirce, especially leveraging Charles W. Morris's refinements of Peirce's theory to facilitate a cartosemiotic study of the triadic relationship between map, map user, and reality. An important difference between this cartosemiotic approach, and more conventional positivist theories, is that positivism purports that these symbols and terms only represent reality, while cartosemiotics is premised on the belief that the map user, or interpreter, is as equally important to the process of communication as that of the map, and what it represents.

In terms of structure, this study posited a three-pronged methodology for the understanding, organizing, and storing of Russian military map symbology and terms. The first prong of this methodology describes how Russian military map symbology and terms should be understood, and proposes the map user does not just determine what a symbol or term means but also uses other knowledge that they have acquired to give context and often provide a deeper level meaning and understanding than could otherwise be gained from the information contained within the map. Meaning that since Russian military map makers assume readers of their maps know the underlying structure of the Russian military, any attempt to fully understand the meaning of Russian military map symbols and terms must in some way provide this essential level of knowledge. Consequently, this study incorporated information about Russian military organization, tactics, and doctrine to provide those unfamiliar with the Russian system sufficient knowledge to comprehend the symbols and terms, as the map makers have intended. Therefore, achieving complete understanding in this endeavor is not just a problem of linguistics, but also a problem of cross-cultural communication.

The second prong of this methodology describes how Russian military map symbology and terms should be categorized and proposes that the process of categorization is not only done for sorting and search purposes but also to facilitate the understanding of complex data. And although there is no 'best' method of categorizing Russian military map symbology and terms, this study has leveraged some of the great semiotic and structuralist thinkers (Eco and Korzybski) whose theories suggest that Russian military map symbology and terms should be categorized so they are 'structurally similar' to the military that they represent. Therefore, this study has used the Russian military's hierarchical and functional organization as the basis for categorization but has also employed a few other schemes to facilitate searching and sorting, and for understanding and comparison purposes.

The third prong of this methodology describes how Russian military map symbology and terms should be collected, organized, and stored using a relational database. This part of the methodology explored the technical aspects of applying the aforementioned categories to a relational database. This was accomplished by developing appropriate entity-relationship models for the data, and then implementing them with a *Microsoft Access* relational database.

Summary and Discussion of Findings

Problems of Translation

This study found that simply translating Russian terms into English is insufficient for a complete understanding as intended by Russian mapmakers. Although 'dictionary' definitions for simple terms (e.g., tank, plane, rifle) will suffice, more complex concepts

were often found to have no exact English equivalent, even though a literal, and technically correct, dictionary definition was available. Therefore, attempting a word-for-word translation of every term in these circumstances results in an imprecise (at best) or incorrect translation. Perhaps this sentiment is best expressed by the preeminent Sovietologist Dr. Phillip A. Petersen.

> In 1977, I was hired by the United States Government to serve as an analyst of the Soviet military. As I struggled to make sense of my research, first at the Library of Congress and then at the Defense Intelligence Agency, it slowly dawned upon me that terms translated from Russian to English languages didn't always make sense, even when technically correct. Furthermore, I observed that the Soviets were very consistent in their word choice, when in English multiple word choices might have been equally acceptable to render a literal translation. Beyond this observation, because word choice in the English language had equally unique meanings for the American military, fundamental misunderstandings could result. For example, the difference for a translator between air "action" and air "operations" might well seem insignificant, but missed the point entirely concerning conveying the scale of activity being discussed. I had missed this point myself in my initial work on the *vodushnaya operatsya* (air operation), and understood that the prerequisite to comprehension was an understanding of how the Soviets thought about warfare. Subsequently, I came to understand that the intellectual construct developed in Soviet military theory extended from the application of military power to the development of that power. This realization led me to illuminate the Soviet framework to facilitate my own analysis, and the construct was published in several forms as I more fully fleshed out my own understanding of how the Soviets attempted to provide a rational structure to the process of preparing for and conducting warfare. (Petersen, 2014, p. 2)

The semiotic approach of examining the relationship between the map, map user, and reality resulted in this study reaching the same conclusion as Dr. Petersen, finding that the Russian's use of military terminology (word choice) is usually quite precise, and this terminology may be translated in a variety of ways that may convey a different meaning to a foreign reader, unfamiliar with the Russian military system then intended by the Russian

map maker. Therefore, this study proposed that the understanding of Russian military map symbology and terms requires not just translations of terms, but also requires definitions for these terms. In some cases, multiple definitions may be required, as occasionally, Russian terms may have several definitions depending on time and context. Although providing these definitions is well beyond the scope of this study's objectives, the acquisition, and cataloging of these definitions may be an area of interest for future research, as the database developed for this study could easily be modified for this purpose.

False Equivalencies

As there can be no simple one-for-one translations of Russian military terms into English, there also can be no simple one-for-one translations of Russian military map symbols into other map symbology systems, and by extension categorization schemes designed for other map symbology systems are ill-suited for categorizing Russian military map symbols. This finding, from a semiotic perspective, is premised on the belief that symbology systems are structured to resemble the phenomena they represent. Hence, the Russian military symbology system is structurally similar to the Russian military it represents, as, for instance, the US/NATO military symbology system is structurally similar to the US/NATO military. Therefore, this study found that attempting to categorize Russian military map symbology and terms by Western (US/NATO) categories (or vice versa) results in a distortion of understanding of the relationships of the represented phenomena.

This finding is in contradiction of current US/NATO views on military map symbology. According to US/NATO documentation, the US/NATO map symbology system is designed to provide standardized symbology to ensure the interoperability of NATO members to facilitate command and control systems, operations, and training. Also, this system is intended to be used to represent the militaries and military activities of other (non-NATO) nations (NATO Standardization Agency, 2011, p. xi). Although the US/NATO system purportedly may be universally applied, there were several problems discovered when attempting to apply this NATO methodology to Russian military map symbols. Most notably, Russian military map symbology was found to have no equivalent to an important category of US/NATO symbols referred to as "tactical mission task symbols" as specified in US Army Doctrine Reference Publication 1-02, *Terms and Military Symbols*.

> A task is a clearly defined and measurable activity accomplished by individuals or organizations. A tactical mission task is a specific activity performed by a unit while executing a form of tactical operation or form of maneuver. A tactical mission task may be expressed as either an action by a friendly force or an effect on an enemy force (FM 3-90-1). The tactical mission tasks describe the results or effects the commanders want to achieve. (Department of the Army, 2018, p. 9-1)

The reasons for Russia not employing US/NATO style "tactical mission task symbols", lie in fundamental differences between the ways that Russia and NATO conduct military planning. The US/NATO symbology system supposes that foreign armies plan and execute tactics like NATO. This planning and execution rely upon the German concept of *Auftragstaktik* or 'mission command', which is a philosophy that explicitly encourages subordinate leaders to take initiative within the context of the commander's

intent. Therefore, "tactical mission task symbols" are sensible from a US/NATO perspective, because these symbols describe *what* results or effects the commander wants to achieve, but do not explicitly describe *how* to achieve these results or effects.

Russian planning and execution is fundamentally very different than the aforementioned concept of 'mission command', and is better described as a system of command and control, rather than a philosophy. In the Russian system, commanders especially at the lower end of the tactical spectrum, have little or no concept of 'commander's intent', as higher-level commanders explicitly state the conditions of success for their subordinate commanders (McDermott & Bartles, 2020, pp. 27-28). For this reason, Russian planning and execution include not only descriptions of *what* to achieve, but also *how* to achieve it. In this system, the use of US/NATO-style "tactical mission task symbols" that only describe *what* a commander wants to achieve is unfeasible. This view was well supported by the evidence collected and analyzed for this study. Of the twenty-three US/NATO "tactical mission task symbols", the Russian symbology system was found to have only three equivalent symbols of this category (attack by fire, destroy, and disengage), as seen in Figure 5.1.

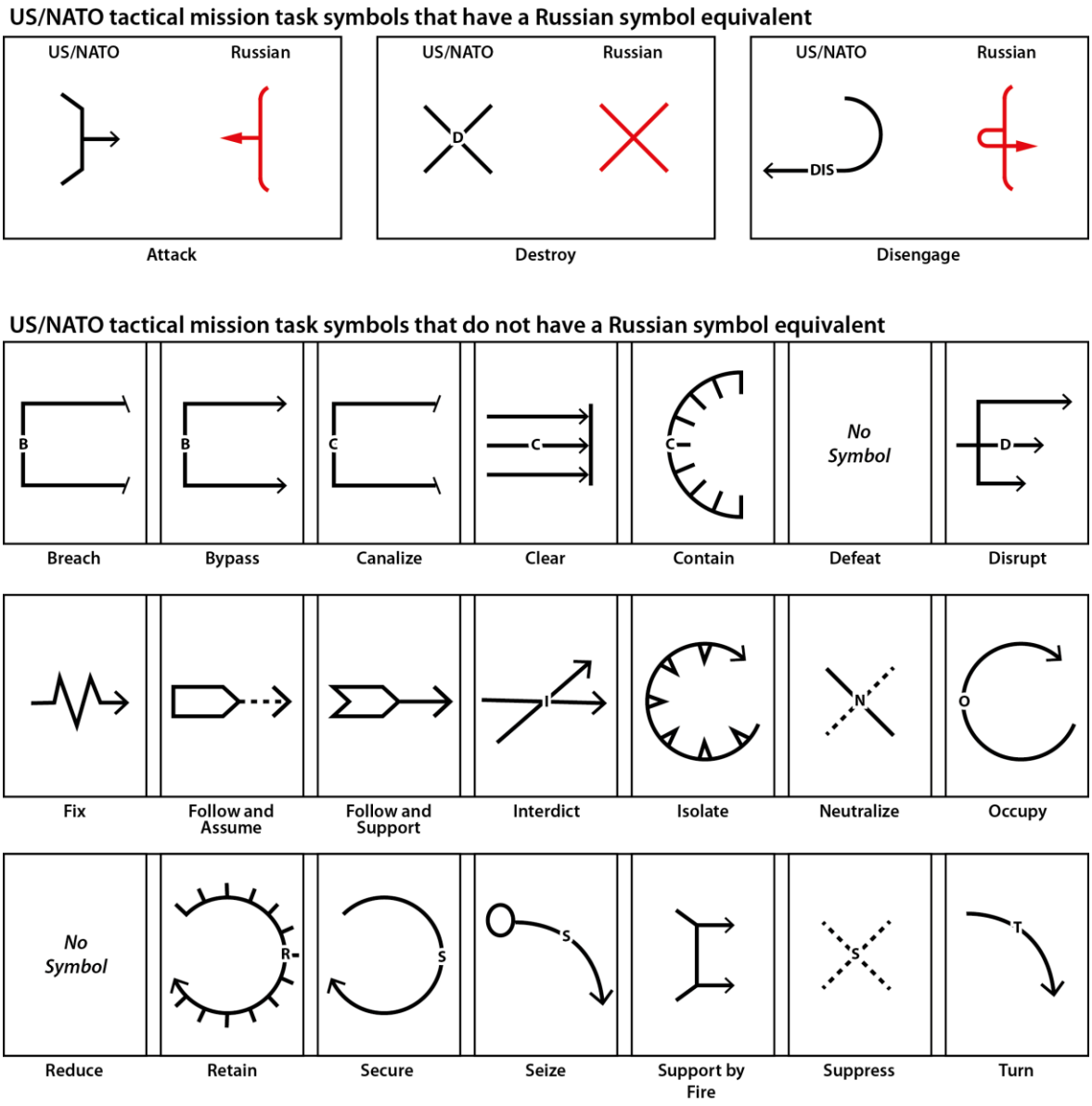


Figure 5.1. Comparison of US/NATO tactical mission task symbols.

Further complicating the matter is that although Russian symbols and terms may have similar equivalents, occasionally the exact meanings may differ in certain situations. For example, the US tactical mission task symbol denoting “destroy” has the same meaning as its Russian equivalent when used in terms of a piece of equipment or vehicle.

For instance, in both the Russian and the US/NATO system, the phrase "the vehicle was destroyed" has the same connotation. But differences in understanding can be seen when the term "destroy" is used in reference to a military unit (i.e., brigade, battalion, company, etc.). In the US/NATO system, a military unit is considered "destroyed" when it has been attrited by 30% or more of its combat power (Department of the Army, 2020, pp. 3-25). In the Russian system, a military unit is considered "destroyed" when it has been attrited by 50%-60% or more of its combat power (Litvinenko, 2019, p. 18). Due to different assumptions about what the term "destroyed" means, map readers may have radically different expectations about the reality that these symbols are depicting.

The reason for this disparity can most easily be seen in the US Army's definition of a tactical mission task symbol, which is defined as a "clearly defined and measurable activity" (Department of the Army, 2018, p. 9-1). Since these symbols are intended to have a specific meaning for a US/NATO map user, which could differ substantially from a Russian definition, false equivalencies (misinterpretations) are likely in any situation where Russian map symbols are "converted" into US/NATO symbology. Therefore, this study suggested that such practices should be avoided.

Another example of such false equivalencies can be seen when Western notions of echelons (companies, battalions, brigades, etc.) were applied to their Russian namesakes. For example, believing that a Russian artillery brigade has approximately the same size, capabilities, and purpose as that of a US/NATO artillery brigade. This distortion of understanding occurs because the US/NATO symbology system is designed to mirror the force structure of US/NATO militaries, and when these US/NATO symbols are applied to

Russian units, those familiar with the US/NATO system often incorrectly assume that Russian units are similar to the US/NATO units that they are familiar, creating misunderstandings regarding the size, capability, and purpose of any given Russian military unit. This problem becomes particularly apparent when reading United States Army Europe's *Torgau Tactical Interoperability Guide* (United States Army Europe, 2006), a reference document published in 2006 to facilitate US/NATO and Russian military cooperation. As shown in Figure 5.2., the authors have provided a one-for-one translation of Russian symbols and terms, that suggests equivalency with US/NATO symbols and terms.

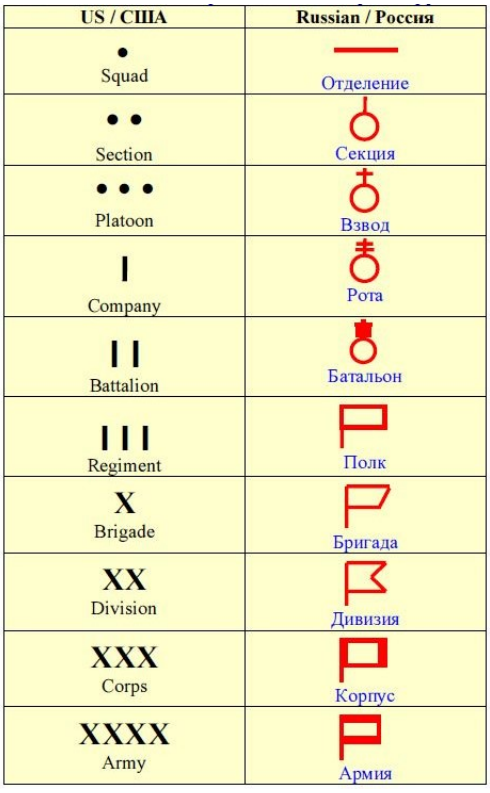


Figure 5.2. Echelon comparison (traditional interpretation). From the *Torgau Tactical Interoperability Guide* (p. 57), by United States Army Europe, 2006. In the public domain.

The United States Army Europe's approach of simply equating Russian echelons to US/NATO echelons is problematic for several reasons, and distorts the meanings of these Russian symbols and terms to those familiar with the US/NATO symbology system, as will be explained. The first example can be seen by examining relative unit personnel strength at echelon, as shown in Figure 5.3. The battalion is generally considered to be the lowest-level echelon capable of conducting limited independent operations, and are the "building blocks" of both the Russian and US/NATO militaries. In US/NATO most battalions have approximately 800 personnel, while in the Russian military battalions have approximately 500 personnel. The difference of sizes between these fundamental structures at the lowest levels results in higher-level US/NATO echelon formations having thousands or tens of thousands of more personnel than their Russian namesakes. This example demonstrates how simple equivalencies can distort meanings, and cloud the understanding that Russian units tend to have less personnel than their US/NATO namesakes at all levels.

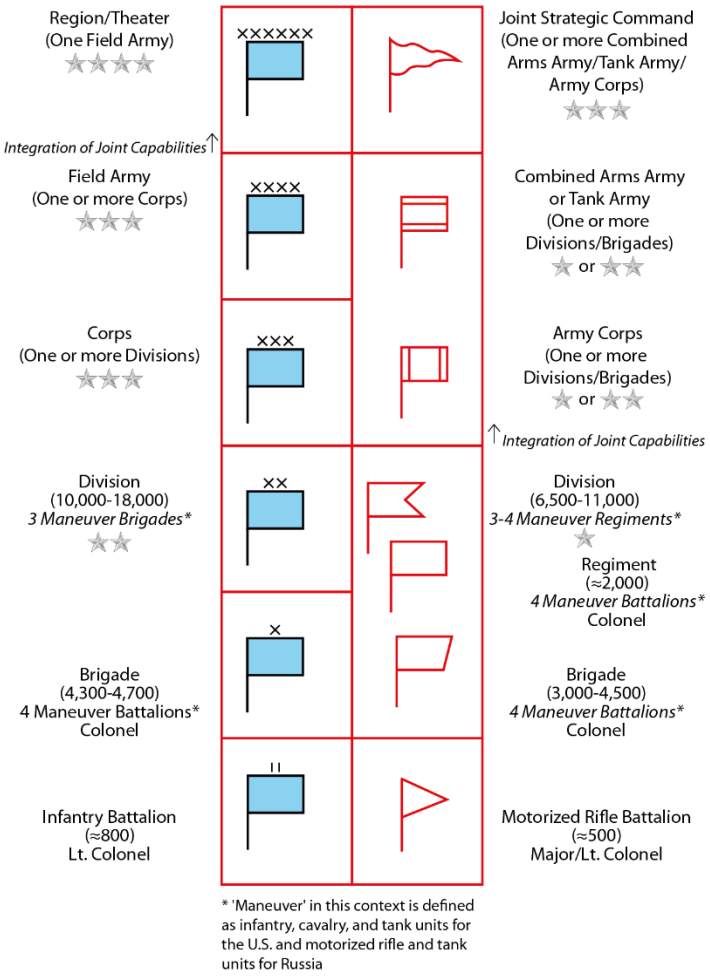


Figure 5.3. Echelon comparison (semiotic interpretation).

Aside from quantitative differences about unit personnel strength, organizational differences between the Russian and US/NATO militaries are also misinterpreted by way of simple equivalencies. As shown in Figure 5.2, The United States Army Europe graphic suggests that the organization of the US/NATO and Russian militaries are of a hierarchical and neatly nested nature with multiple battalions forming brigades, multiple brigades forming divisions, and multiple divisions forming corps, and multiple corps forming armies. Although this description is accurate regarding US/NATO units, it is much less so

regarding Russian units. As shown in Figure 5.3, the Russian military's hierarchical structure is substantially different. In the Russian system, multiple battalions may form regiments, with multiple regiments forming divisions; or battalions may form brigades. These divisions and brigades may be part or corps or armies, which in turn form a joint strategic command.

In addition to personnel and hierarchical difference, there are other differences between these systems that are glazed over when only simple equivalencies are employed. As shown in Figure 5.3, Russian units tend to be commanded by officers of junior grades *vis-à-vis* their US/NATO namesakes. (For example, a Russian division is commanded by a one-star general while a US/NATO division is commanded by a two-star general.) But there are also more subtle, and perhaps more important differences that are overlooked. Most importantly, from a military perspective, is the level at which joint capabilities (the capabilities of different branches of service — Army, Navy, Air Force, etc.) are integrated. As shown in Figure 5.3, this integration occurs at a much lower level in the Russian military than in US/NATO militaries.

This comparison between a traditional interpretation (Figure 5.2), conducted by only performing simple equivocations of Russian symbols to US/NATO symbols, and a semiotic interpretation (Figure 5.3), conducted by not only translating the symbols but also through the use of critical analysis to provide necessary background and context to impart a fuller understanding, demonstrates the inherent limitations of a traditional (equivocal) interpretation and advantages of a semiotic interpretation. And shows the practical value of Peirce's triadic-system of understanding meaning — that puts as much emphasis on the

interpreter (signified), as it does the symbol (signifier) and thing (object) to which is being referred — in facilitating cross-cultural communication by explicitly describing assumed norms.

Symbology's Role in Understanding the Russian Military

This study is premised on the findings cartosemiotic scholarship, most notably the work of Jacques Bertin, which suggests that cartographic representations do not just merely reflect reality, but can also reveal new knowledge about the phenomena that they represent. In line with this thinking, this study has proposed that Russian military map symbols have a role in furthering our understanding of the Russian military. As discussed in the proceeding chapter, objects and events that are deemed to be important to the Russian military, such as water crossings, artillery firing schemes, deception plans, etc., have particularly well-developed symbol sets. This means, at a very base level, Russian military map symbology provides a window to discover what sort of military objects and events, the Russian military deems important.

More complex manifestations of this phenomena can be seen when interpreting the way these symbols interact within the historical maps, commanders' working maps, and doctrinal templates. One of the most interesting examples, as discussed in the previous chapter, can be seen in how Russians depict movement. Unlike the US/NATO system, in which cartographic representations do not show movement, Russian cartographic representations routinely do show movement. As noted by renowned Soviet military scholar Charles Dick. "[T]he Soviet [Russian] map marking system is well suited to depicting movement and action and less well suited to depicting static positions…Static

defensive positions are rarely found in Soviet magazines and manuals, except when dealing with tactics of Western Armies" (Dick, p. 3). Dick's insight about this difference between the Russian and US/NATO mapping systems, is also reflective of broader institutional differences between the Russian and US/NATO militaries. As the Russian military puts far greater emphasis on maneuver and mobility, for both offensive and defensive purposes than the US/NATO military. In sum, the study of Russian military map symbology should not just be seen as a study of cartographic representations, but also as a tool to provide a better understanding of the Russian military itself. This indirect manner of attaining knowledge is particularly valuable for this topic due to the remote and/or secretive nature of certain military activities which may prevent observation of the phenomena (Russian military) itself.

Military Map Symbology as a Predictor of the Future

Although this study was based upon a cartosemiotic methodology, perhaps one of the most interesting ideas that it proffers comes not from semiotics, but by way of critical cartography. Much as Bertin expanded cartographic thought by suggesting that cartographic representations could reveal new knowledge about the phenomena they represent; critical cartographers, such as Pickles and Wood, would go a step further and proffer that cartographic representations not only describe reality but can also shape it. The idea that a cartographic representation can shape reality, may seem farfetched, but county zoning maps are certainly one such practical example. These maps are essentially governmental decisions about the types of development that are permitted in given areas, expressed in the form of a geographic representation. In a very real sense, the ability of

county zoning maps to prohibit and encourage different types of development controls the way a given community will look in years to come, hence showing how maps can shape the future.

The research conducted for this study revealed several such examples of how Russian military map symbols can offer similar looks into the future. As mentioned in the previous chapter, a commander's working map is a cartographic representation that not only shows the current disposition of forces but also shows a Russian commander's plan for future dispositions and actions, thereby showing how Russian cartographic representations can predict possible future outcomes in the near term.

In addition to forecasting future reality in the near term, Russian military map symbols may also be able to provide longer-term forecasts. This can be seen in the way that the Russian military is contemplating how robotics will be employed on the battlefield. Robotic systems in the form of unmanned aerial vehicles (UAVs) have been rapidly matriculating into the Russian arsenal since 2010, the use of unmanned ground vehicles (UGVs) is still in the experimental stages. Although UGVs are not currently in Russia's operational forces, an article by S.I. Pasichnik, A.S. Garvardt, S.A. Sychev, in a 2020 edition of the Russian *Journal of the Academy of Military Science*, provided a map that describes how Russian UGVs could be employed on future battlefields (Pasichnik, Garvardt, & Sychev, 2020, p. 39). As shown in Figure 5.4, a translated version of this map, there are symbols for UGVs and the mobile command posts to control the UGVs. These symbols are particularly interesting because this is the first time that symbols for UGVs and their mobile command posts have been seen, but perhaps more importantly,

these symbols are predicting *how* such systems could be used in the future, at a time when such systems are not even in serial production.

As can be seen in Figure 5.4, these new technologies appear to be involved with several different activities on the battlefield. On the left side, UGVs are apparently being used for reconnaissance and fire suppression. In the middle, UGVs are engaged in breaking through a defense, fire suppression, reconnaissance, and supporting mine clearance. On the right side, there are two reserves of UGVs, which are likely intended for mine clearance, strong-point reduction, and/or exploitation. Although this vision of how robotics on the battlefield may never come to pass, it at least gives some idea of how Russians are contemplating the use of such technologies in the future and therefore is of significant interest.

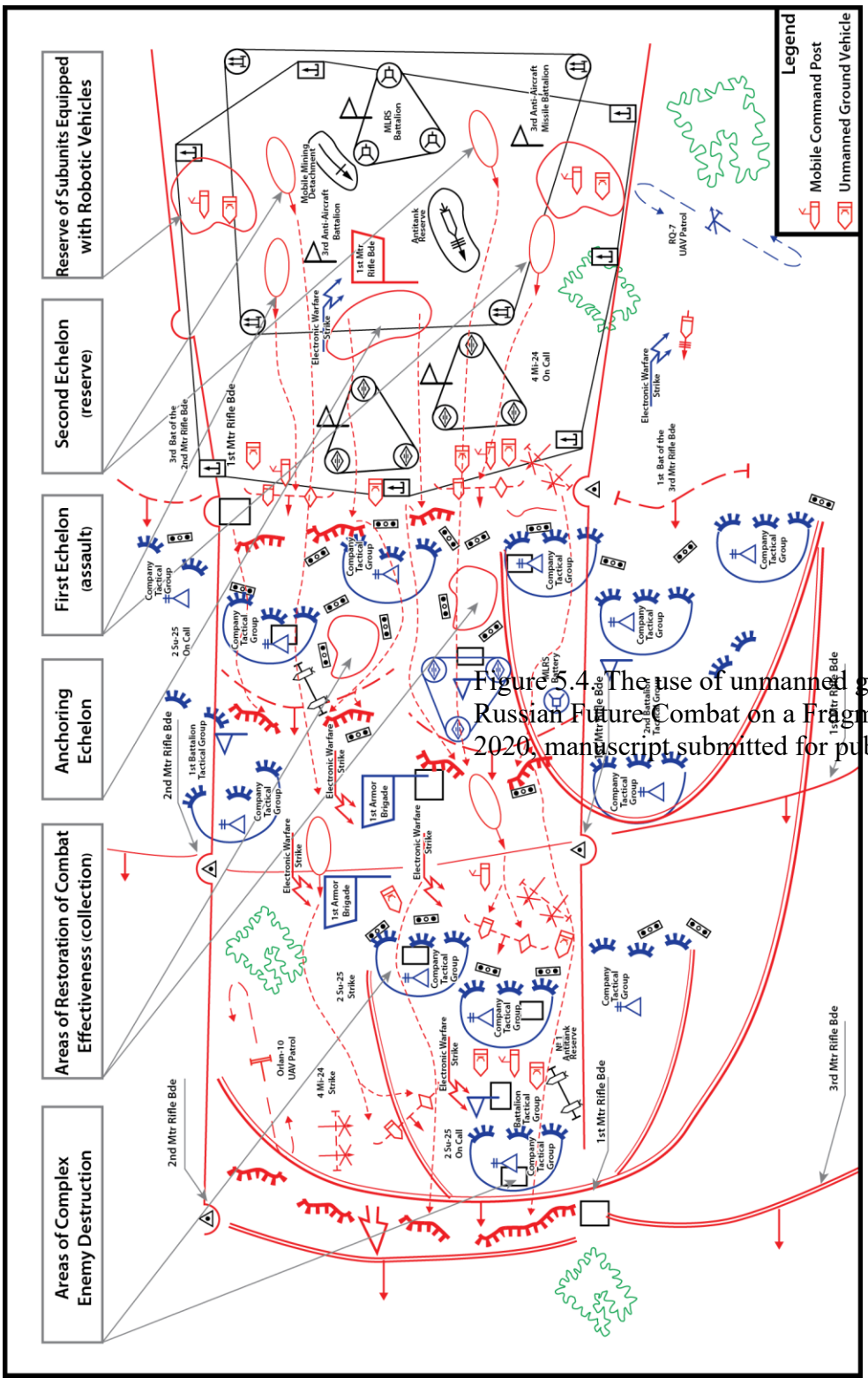


Figure 5.4 The use of unmanned ground vehicles on a future battl
Russian Future Combat on a Fragmented Battlefield, by L. W. Gra
2020, manuscript submitted for publication. In the public domain.

Implications for the US and NATO

This study found that attempting to categorize Russian military map symbology and terms by US/NATO categories and methodologies resulted in a distortion of Western understanding of the Russian military. This point is particularly important for the US Armed Forces, as conventional wisdom and current policy is that US/NATO military map symbology and terms are sufficient for representing both the US/NATO and the Russian militaries, and so no effort is made to study Russian military map symbology and terms. When Russian historical maps, commanders' working maps, and doctrinal templates are encountered by US/NATO personnel, the Russian military symbology is typically conducted by way of one-for-one symbol conversions between the Russian and US/NATO systems, and through the translation of the known terms or acronyms into English. Due to the findings previously discussed in this study, many of these conversions result in haphazard cartographic representations that convey a far different meaning, then that initially intended.

Therefore, given the findings of this study, current US/NATO policies and thinking regarding mapping, and in the interests of facilitating a better understanding of the Russian military, there should be some effort made by the US and NATO to more fully understand Russian military map symbology and terms. This understanding is especially important at this time, due to increased tensions between Russia and several NATO member states that have already resulted in casualties. Such high-profile incidents include Turkey's 2015 shoot down of a Russian aircraft in Syria, and the US's air and artillery strike on Russian mercenaries during the 2018 Battle of Khasham, in Syria. Misinterpreting Russian

cartographic representations during this time of already increased hostilities could lead to exceptionally grave consequences.

Since this study found that Russian military map symbology and terms could facilitate a better understanding of the Russian military, an implication of this finding is that the military map symbology and terms of other non-US/NATO states may also be worthy of study. Although the US/NATO and Russian (by way of the Soviets) map symbology systems have been adopted by many nations, several nations have had limited military contacts with the US/NATO and Russia, and so have likely had independently developed their own system of military map symbology and terms, that are designed to represent their unique militaries and understanding of the conduct of warfare. From a US military perspective, the most important nations in this category include China, Iran, and North Korea. These nations are important because they, along with Russia, are part of the "four-plus-one" model that the US Department of Defense uses for benchmarking purposes to assess the capability developments of potential adversaries. The 'one' in the model, stands for the threat of violent extremism (Garamone, 2016).

Limitations of Research

The fundamental goal of the study was the interpretation and organization of Russian map symbology and terms so that the intent of the Russian mapmaker is understood by the map reader as accurately as possible. For this purpose, the application of a semiotic methodology, which examines the triadic relationship between representation, user, and reality were most appropriate to ensure complete understanding. Since the relationship between signifier and signified is learned, the only way for the same

meaning to be conveyed between two individuals is to ensure that they have a shared common set of norms to facilitate communication.

At a base level, this lack of 'complete understanding' is not a problem. A semiotic methodology is not required for the understanding of common terms such as "tank", "airplane", or "rifle", as these terms require only translation, but organizational and conceptual terms are a different matter. For example, the term "*brigada*" or "brigade" is a familiar military term in both colloquial Russian and English, but for those familiar with the Russian and/or US/NATO military systems, the term has a more specific meaning, relating to the niche that this particular unit fills, and its order in the organizational hierarchy. This study attempted to mitigate some of this loss of understanding by explicitly stating certain relationships and explaining certain concepts, but undoubtedly some loss of understanding will certainly occur.

From a linguistic perspective, establishing norms is in part done through the translation of Russian symbols and terms into English, with their meaning translated in the context that was (likely) intended. But the establishment of a common set of norms for Russian military map symbology and terms is more than a linguistic problem, it is also a cultural one. As the author has had to relate the Russian military system to the reader, often by comparative means, such as explaining a Russian concept in terms of a similar US/NATO concept. This is because to share a common set of norms with the mapmaker, and thereby accurately understand the representation (map, symbols, terms, etc.), this study has had to bridge not only different languages but also different military cultures. Therein lies an inherent limitation of the research. This study presumes the reader has some

knowledge of the US/NATO military system, as, without this knowledge, a complete set of norms cannot be established, and therefore a complete understanding cannot be obtained. An important implication of semiotic theory in regard to this issue is that the interpretant is itself a sign in the mind of the interpreter, so the way an object's (referent's) symbol (representamen) is interpreted can vary by the interpreter. This means that since this study was designed to facilitate understanding for a map reader (interpreter in semiotic parlance) with a familiarity with the US/NATO military culture, so those without this knowledge will be less likely to understand the full meaning of Russian map symbology and terms explained in this manner.

Another limitation of the study in establishing common norms between the mapmaker and the user is the role of the author. This establishment of norms depends on the author's ability to translate the terms as the Russian mapmaker intended. Although the author is well-read on the Russian military, the Russian military has many different communities and interests ranging from soldiers in trenches, sailors at the bottom of the sea, pilots in the sky, cosmonauts in the heavens, and all points in between — so some of the nuances of these communities may be unknown or misunderstood by the author. These nuances may cause terms and symbols to be translated in a manner inconsistent with the mapmaker's true intention.

Perhaps the greatest structural limitation of this study was the use of the semiotic methodology, as it was not the only interpretative method that could have been employed. Hermeneutics, the theory or philosophy of interpretation (usually of a text or discourse), which in many ways is quite similar to semiotics, was also available. This approach is not

concerned with the mechanics of signification as is semiotics, but instead focuses on drawing out the truth or meaning of a text or discourse from the perspective of the author. Although a semiotic approach was deemed more appropriate for this study due to its suitability for conducting detailed structured analysis, the hermeneutic approach may have provided a more holistic analysis of the production, distribution, and consumption of the text (symbology), than semiotics arguably could.

Suggestions for Future Research

This study proposed a semiotic system for the understanding and organization of Russian military map symbology and terms and posits a three-pronged methodology for their understanding, organizing, and storage. This system was designed specifically for the Russian military and Russian language, but likely could be adapted for the understanding and organization of other militaries' systems of symbology and terms. Although this study contrasted the US/NATO and Russian militaries that have had at times a tumultuous relationship, such an approach may also valuable for allies that have different native languages and military traditions.

For example, even close NATO allies, such as the United States and Norway, occasionally have had difficulty conveying a full understanding of important military terms. Major Adrian Rankine-Galloway, spokesman for the United States Marine Corps Forces Europe-Africa, gave the following description of this situation after a recent US-Norwegian military exercise: "While communication among US and Norwegian forces takes place in English without any difficulty [meaning use of the English language], small differences in units' standard operating procedures, professional experiences, and, in some

cases, doctrinal terminology do exist" (Woody, 2020). Since misunderstandings in military situations can lead to grave consequences, military leaders have been keen to realize the importance of good communication and understanding between allies. As Major General Lars Lervik, chief of the Norwegian Army, explains: "One of the most important lessons we have learned is that we need a mutual understanding of what the different military terms mean so that when an order is given, we can both act in the same way" (Woody, 2020). Although the methodology developed for this study was intended for understanding a potential adversary, likely this methodology could easily be modified to provide the "mutual understanding" between allies that Major General Lervik is looking for. In addition to military applications, this semiotic approach could also likely be adapted for the understanding and organization of other fields that have highly specialized symbology and terms, especially in situations where terms are being translated between different languages. These fields could be in the sciences (e.g., geography and geology), or perhaps could be related to industry, such as oil and gas exploration and production.

This study proffered a semiotic approach to understand and organize well over 1,000 Russian military map symbols and 3,000 Russian military terms, with the overall intent of facilitating a better understanding of these symbols and terms, which have been often misinterpreted due to language and cultural differences. To accomplish this goal, this study employed a branch of semiotics, known as cartosemiotics, to examine the triadic relationship between map, map user, and reality, and used the knowledge derived from this process to capture the meaning of these symbols and terms, as was intended by the Russian map makers who created them, in a relational database. This study found no one 'best'

way of categorizing and organizing Russian military map symbols and terms, and proposed that multiple categorizations are needed to facilitate searching and sorting, and meet the differing needs of the interpreter using the database as the needs of the scholar, soldier, cartographer, or analyst may drastically differ. This study also suggested that the process of categorization itself is valuable, as the process can reveal new knowledge about the phenomena that is the Russian military.

APPENDIX A

DEFINITION OF TERMS

Cartography- The term cartography can be used in several ways. In the narrower sense of the word, cartography refers to all aspects of the art and science of graphically representing a geographical area, including the collection and display of associated political, cultural, or other nongeographical data (The Editors of Encyclopaedia Britannica, 2017; Keates, 1996, p. 112). However, this study generally refers to cartography in the broader sense, best summarized by the Soviet cartographer Konstantin Salichtchev (1905–1988) as the science of spatial analysis for investigating and understanding the patterns of natural and cultural phenomena and their interrelationships employing cartographic representations (Salichtchev, 1973, p. 110).

Cartosemiotics- The semiotic study of cartographic models (or cartographic representations). In view of the state of research, the discussion is limited to maps, the most widely used and best studied kind of cartographic models.

Commander's working map- Specialized map produced by Russian commanders and staffs to depict the current disposition of forces and plans for battle. These maps typically consist of Russian military terms, symbols, and acronyms overlaid upon a topographic map.

Military symbol- This study uses the term 'military symbol' in two ways. The first and broadest definition of the term is any combination of graphics, abbreviations, terms, numbers or letters used to represent any military or militarily significant units and headquarters; vehicles; weapons and equipment; individuals; lines of demarcation;

positions and locations; movement and deployment; fortifications and obstacles; structures, bases, depots, and military industry; or concepts (Taylor, 1978, p. iii), This definition comes from a semiotic perspective, as a military symbol can be a graphic, term or acronym expressed in text, or a graphic with embedded or associated textual elements. The second definition of the term used in this study is, as a practical matter, from a data collection and storage perspective. In this context, a 'military symbol' is just a graphic, or graphic with embedded textual elements, while a 'military term' is simply text, or an acronym representing said text. The frequent use of the phrase "military symbols and terms" in this study is for the purpose of emphasizing the importance of both the graphic and textual elements of a given military symbol.

Semiotics- The study of signs which is the fundamentally the study of communications and understanding (Sless, 1986, p. 5).

Semiosis- The process of interpreting signs, through which communications and understanding are possible (Sless, 1986, p. 5).

Russian military- The uniformed military forces serving the Russian Federation. The largest of these forces are found in the Ministry of Defense, National Guard of the Russian Federation (*Rosgvardiya*), and the Federal Security Service's Border Service.

Russian Armed Forces- This term refers specifically to the uniformed military forces serving in the Ministry of Defense, including the Ground Forces (GF), Aerospace Forces (VKS), Navy (VMF), Strategic Rocket Forces (RVSN), and Airborne Troops (VDV).

APPENDIX B

STANDARD RUSSIAN MILITARY MAP SCALES

1:1,000,000 Scale: The Russian system of cartography is based upon 1:1,000,000 scale sheet, that cover 4° of latitude and 6° of longitude, and is designated by a Roman letter and Arabic number, such as M-36. This system is based upon the conventions of the International Map of the World (IMW) system (Department of the Army, 1958, p. 2). The 1:1,000,000 scale is intended for the study of the general nature of terrain to support planning, conducting command and control of large military units, and certain other tasks, such as the conduct of airborne operations (Psarev, 2005, p. 46).

1:500,000 Scale: Each 1:1,000,000 scale map is divided into four 1:500,000 scale map sheets, each covering 2° of latitude and 3° of longitude, and is designated by the number of the 1:1,000,000 scale map in which it resides, plus its respective quadrant designator with capital case Russian letters: Russian letters “А” for Northwest quadrant, “Б” for the Northeast quadrant, “В” for the Southwest quadrant, and “Г” for the Southeast quadrant, such as М-36-Г (Department of the Army, 1958, p. 2). The 1:500,000 scale is intended for the study of the general nature of terrain in the preparation and conduct of operations, conducting command and control of large military units, and military aviation purposes. (Psarev, 2005, p. 46).

1:200,000 Scale: Each 1:1,000,000 sheet is divided into 36 1:200,000 sheets, each covering 40’ of latitude and 1° of longitude, and is designated by the number of the 1:1,000,000 scale map in which it resides, plus its respective designator annotated by a Roman numeral, such as M-36-XX (Department of the Army, 1958, p. 4). The 1:200,000

scale is often used as a road map, the understanding general topography, and for aviation purposes. (Psarev, 2005, p. 46).

1:100,000 Scale: Each 1:1,000,000 sheet is divided into 144 1:100,000 sheets, each covering 20' of latitude and 30' of longitude, and is designated by the 1:1,000,000 sheet number, followed by an Arabic number, such as M-36-18 (Department of the Army, 1958, p. 7). The 1:100,000 scale is intended for the study of terrain for planning operations; conducting command and control of large military units, orientation and targeting, analyzing order of battle, determining the coordinates of enemy targets, and certain engineer activities. The typical accuracy of this scale is 50-100 meters (Psarev, 2005, pp. 45-46). The relief on these maps are typically indicated by 20-meter contour lines. Prominent mounds and depressions are indicated by a symbol with a plus or minus sign to indicate the relative change of elevation (Taylor, 1978, p. 12).

1:50,000 Scale: Each 1:100,000 sheet is divided into four 1:50,000 sheets, each covering 10' of latitude and 15' of longitude, and is designated by the number of the 1:100,000 scale map in which it resides, plus its respective quadrant designator with capital case Russian letters: "А" for Northwest quadrant, "Б" for the Northeast quadrant, "В" for the Southwest quadrant, and "Г" for the Southeast quadrant, such as M-36-18-Г (Department of the Army, 1958, p. 8). The 1:50,000 scale is intended for the detailed study of terrain for orientation and targeting. It is used by units for various types of combat, especially in the defense. In offensive operations, it is used to study the terrain to facilitate: the breakthrough of enemy defenses; water crossings; airborne and amphibious landings; artillery fires; urban combat operations, if maps of a more suitable scale are not

available; and certain engineer activities. The typical accuracy of this scale is 25-50 meters (Psarev, 2005, p. 45). The relief on these maps are typically indicated by 10-meter contour lines. Prominent mounds and depressions are indicated by a symbol with a plus or minus sign to indicate the relative change of elevation (Taylor, 1978, p. 12).

1:25,000 Scale: Each 1:50,000 sheet is divided into four 1:25,000 sheets, each covering 5' of latitude and 7'30" of longitude, and is designated by the number of the 1:50,000 sheet in which it resides, plus its respective quadrant designator with lower case Russian letters: "а" for Northwest quadrant, "б" for the Northeast quadrant, "в" for the Southwest quadrant, and "г" for the Southeast quadrant, such as M-36-18-Г-б (Department of the Army, 1958, p. 8). The 1:25,000 scale is the most detailed and accurate map normally available. It is intended for detailed study to facilitate: water crossings, airborne and amphibious landings, and urban combat operations. This scale is also suitable for engineering studies and artillery purposes such as determining firing positions, and observation and reference points. The typical accuracy of this scale is 15-25 meters (Psarev, 2005, p. 45). The relief on these maps are typically indicated by 5-meter contour lines. Prominent mounds and depressions are indicated by a symbol with a plus or minus sign to indicate the relative change of elevation (Taylor, 1978, p. 12).

1:10,000 Scale: Each 1:25,000 sheet is divided into four 1:10,000 sheets, each covering 2'30" of latitude and 3'45" of longitude, and is designated by the number of the 1:25,000 sheet in which it resides, plus an Arabic numeral, such as M-36-18-Г-б-2 (Department of the Army, 1958, p. 9).

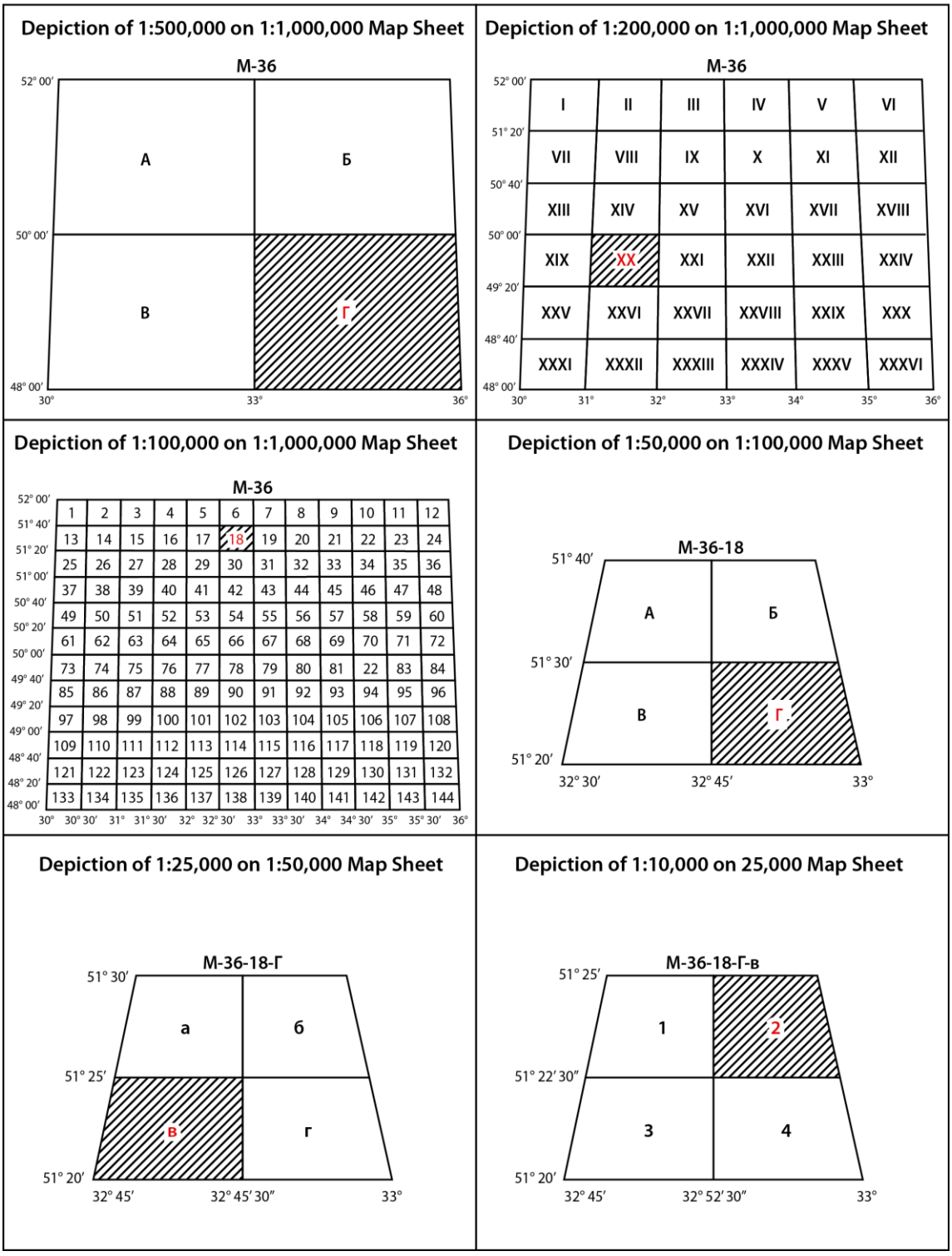


Figure A1. Comparisons of standard Russian military topographic scales. Adapted from Soviet topographic map symbols (p. 2-9). Department of the Army, 1958. In the public domain.

APPENDIX C

COPYRIGHT PERMISSION

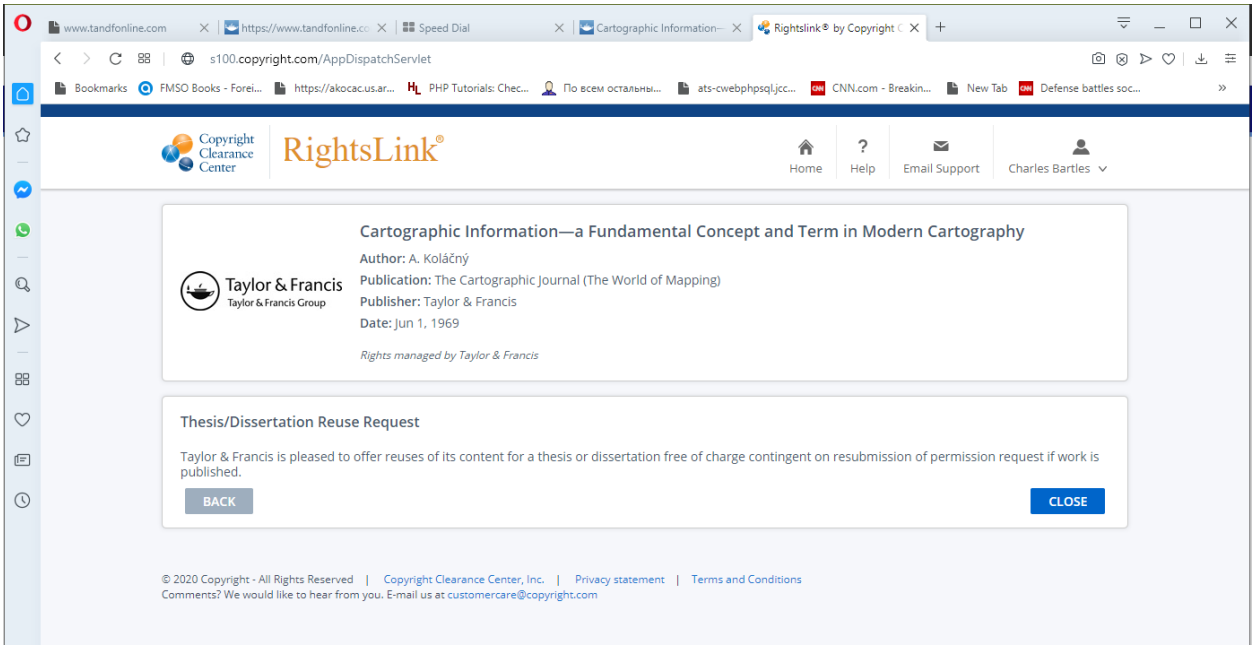


Figure B1. Copyright permission for the adaptation of Figure 3.2.

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