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The Russian Military Decision-Making Process & Automated Command and Control

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Table of Content

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Introduction

Russia's Armed Forces have their own distinctive military culture and approaches to the entire panoply of military issues.[1] This is especially the case when it comes to the complex processes involved in military decision-making, as this includes the structures of the Armed Forces, military personnel as well as reliance upon and use of modern technologies. In the early 2000s, for example, the Russian Armed Forces were unable to generate digital communications through the command and control (C2) structures and had to rely upon a paper-bound process.[2] This is no longer the case, as modernization of the C2 has since markedly progressed. This decision-making process is clearly distinctive in a Russian context, and not only reflects their unique military culture but also the changing nature of modern combat and operations in an information-centric era.

The following study explores the complex contours of the process of decision-making in the Russian military, as well as the various influences involved and how this differs so vividly at times from the approaches or standard methods used in NATO militaries. The study avoids examining the theory of military decision-making, and concentrates instead on the practicalities of who is involved and how this complex process is handled. It aims to inform defense planners and military decision-makers within the transatlantic Alliance, providing for a better understanding of the nature of this complex process in Russia's Armed Forces. Particular focus lies on identifying the areas in which Russia's Armed Forces are making progress to improve the speed and effectiveness of military decision-making, as well as on exploring some of the challenges and potential vulnerabilities.

Consequently, the monograph divides into five parts. In the first, the Russian military decision-making architecture is outlined, to show what elements of the state and its military machinery are involved in or influence the decision-making process. The second part looks at how this process unfolds or is handled at the various levels from strategic to operational and tactical levels. The third part examines the critical part played by the transition of the Russian

1 Roger McDermott wishes to express his gratitude to support for an earlier single-authored version of this study from the Norwegian Defence Research Establishment (*Forsvarets Forskningsinstitutt* – FFI).

2 Leonkov 2018.

Armed Forces into the information era, specifically the pivotal role played by automated command and control systems. In order to avoid misrepresenting the extent to which advances have been made in this area, primarily as a result of the reforms in the Russian Armed Forces initiated in late 2008, some of the challenges and vulnerabilities facing Russian military decision-making will also be assessed.

The fourth part provides some comparative analysis between the Russian and US/NATO military decision-making systems to facilitate understanding of the implications of Russia's C2 modernization. The fifth, and final, part describes the specific C2 systems that are being fielded in Russian Ground Forces, potential theories of their implementation, advances in computer and communications technology, and some thoughts about the importance of Russia's automatization of C2 capabilities.

The eighteenth-century Russian military leader Alexander Suvorov (1729-1800) rightly identified the importance of speed and time in achieving success on the battlefield: "One minute can decide the outcome of the battle, one hour - the outcome of the campaign, and one day - the fate of empires." This observation is even more accentuated in modern approaches to the conduct of warfare, reflecting the fact that its means and methods have radically shifted away from platform-centric models through the exploitation of advanced technologies in the information era. This has compelled shifts in how modern militaries assess, use and try to manipulate time and space factors in their planning processes. Russia's political-military leadership has recognized this evolution in modern warfare and as a result conducted systemic changes to its Armed Forces' structures, at the same time also introducing modern technologies and approaches to the conduct of combat and operations. A crucial driving factor in these efforts to reform and modernize Russia's military is the focus on enhancing the speed and efficiency of the C2 bodies to achieve the aim of improving decision-making and the timely execution of decisions. In short, their aim is to be able to act faster than the potential adversary.[3]

The complexity of describing and assessing this process in Russia's Armed Forces partly stems from an issue of terminology. Many of the terms used by US or NATO militaries do not quite fit the Russian context. For example, the term anti-access/area denial (A2/AD) is a familiar one to Western militaries. However, when the term features in Russian military publications it is always used to refer to foreign militaries and their approaches to this concept. Nonetheless, there is clearly a set of capabilities in existence in the Russian military which, when combined, does, in fact, constitute an A2/AD capability.[4] Similarly, in US

3 Ramm/Valchenko 2017.

4 Author interviews with retired Russian officers, Moscow, May 2017: Rossiyskiye 'Iskandery' vpervyye perebrosili na ucheniya v Tadzhikistan [Russian 'Iskanders' were transferred to Tajikistan for exercises for the first time], *Nezavisimoye Voyennoye Obozreniye*, May 25, 2017, http://www.ng.ru/news/582227.html, last accessed on 01 February 2020. Borzov 2010.

and NATO parlance the term Military Decision-Making Process (MDMP) is not only common, but military personnel are expected to

be familiar with the constituent parts of both the long and shortened versions of this MDMP. In Russian military publications, the term again is always used to describe how foreign militaries conduct the MDMP.[5] It is not a term in use within the Russian Armed Forces, even though such a process evidently exits.[6] The authors have had no access to current Russian military regulations, since these are classified and accessible primarily to serving military personnel, but they have been able to attain relevant information from other sources (see footnote 6).

Apart from the wider body of military publications, the term (MDMP) cannot be found in *Voyennaya Entsiklopediya or Voyennyy Slovar* [Military Dictionary]. However, the notion of an MDMP certainly exists within the Russian military along with its algorithm and checklist. Indeed, it is the main element in the formal procedure of battle-order (*boyevoy prikaz*) development. According to *Voyennyy Slovar*, the *boyevoy prikaz* development follows a set pattern. It sets tasks for subordinate forces during the preparation and conduct of combat operations. These should be "brief, extremely clear, excluding the possibility of different interpretations." It includes an overview of the force grouping command element and the likely nature of the ensuing actions, delineates the combat mission, plans the combat operation, sets priorities, and distributes the tasks and objectives to the relevant force elements. The orders can then be issued in written form or orally.[7]

In the absence of a "go to" source to describe and assess the Russian MDMP, it is necessary to discover its outlines by taking a different approach. The authors deduce some of the critical elements of the process through analysis of the post-reform command structures for combat operations.[8] More information is gained from examining how the Russian General Staff and military planners and commanders view the strategic, operational and tactical levels of operations and how this influences their MDMP. It is argued that the transition toward network-centric approaches to warfare, with the introduction of auto-

5 Author correspondence with retired Russian military officers, April 2019.

6 For the purposes of this study, the term "Military Decision-Making Process," when used at the operational and strategic levels, will refer to the general way that the Russian military conducts decision-making, but when this term is used at the tactical-level, it refers specifically to a much more methodological process, especially at the battalion level. Although the Russian military does not have an equivalent of the US military's Joint Publication 5-0, Joint Planning, or the US Army's Army Doctrine Publication 5-0, The Operations Process that rigidly defines Russian operational and tactical planning, the observations about how Russians conduct tactical-level planning have been attained from a number of primary and secondary sources. These include the "Combat Regulations of the Ground Forces;" discussions with, and observations of, post-Soviet officers; and Russian training materials and books such as "The Artillery Battalion in Battle" and the "Battalion Staff in Battle."

7 *Voyennyy Slovar*, https://encyclopedia.mil.ru/encyclopedia/dictionary/details_rvsn.htm?id=3549@morfDictionary, last accessed on 03 May 2019.

8 Grau/Bartles 2017.

mated C2 and indeed wider adoption of C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance), plays a unifying role in this process which is designed to maximize speed and efficiency. Summing up, the sources for this report are almost exclusively Russian military publications and professional Russian military journals.

1 The Russian Military Decision-Making Architecture

1.1 Russia's Adoption of Network-Centric Warfare Capability

> Network-centric war—A concept of military operations oriented towards the achievement of information superiority that provides for an increase in the combat power through the creation of an information and communication network linking sensors (data sources), decision makers, and assets. This network ensures that the participants of operations have situational awareness and accelerates command and control, increasing the pace of operations, effectiveness of defeating enemy forces, survivability of troops, and level of synchronization.[9]

The military decision-making process in Russia's Armed Forces must be understood in the context of its military reform and modernization since 2008, and, in particular, the conceptual shift that has attended these developments. As already noted, the decision-making process until these reforms were initiated was largely paperbound. The transformation in Russia's Armed Forces over the past decade has been driven by the transition of the force structures into the modern information era. Conceptually, Moscow has placed C4ISR capability and enabling the Armed Forces to introduce network-centric approaches to warfare at the epicenter of its transformation and modernization drive since 2008.[10]

It is a unifying theme in the transformation, underpinning the defense industry's support for modernization, and it guides and shapes experimentation with force structure, manpower and the application of network-enabled operations in an informationized combat environment. During an author interview in Moscow in October 2010, the intellectual "father of the military reform," Colonel (retired—died 2011) Vitaly Shlykov, explained that although the level of understanding of network-centric warfare concepts among senior Russian officers and in the political establishment was not too advanced, it was sufficient to use it as a means to "put fire under" the domestic defense industry and provide an overall aim for the reform process. Therefore, initially used as a mechanism to promote reform and modernization, within the past several years this pro-

9 Tyutyunnikov 2018: 160.

10 Garavskiy 2010. Cheltsov, B, Zamaltdinov, I, Volkov, S, 'NATO and western countries' work on 'network-centric' warfare and Russia's slowness in this area,' *Vozdushno kosmicheskaya oborona*, 21 June, WNC, accessed 30 October, 2009.

cess has matured and moved significantly to the stage of implementation and working out its implications for future force development.[11]

This resulted in numerous practical experiments, advances in capability and the slow but highly important step of developing and procuring automated command, control and communications systems. Progress is also evident in introducing improved surveillance and reconnaissance capabilities, combined with vigorous efforts to upgrade and innovate in terms of electronic warfare, which Russian defense planners see as symbiotic with progress in network-centric capability. Some of these unifying features in Russia's ongoing military transformation provide pointers as to the likely shape and extent of its future conventional military capability. The network-centric capability will prove to be more important for Russian military planners as a tool set to indirectly challenge the US and NATO or other powers on Russia's periphery. By adopting network-centric approaches to modern warfare, the General Staff seeks to use this as a means to enhance the speed of C2 and therefore to greatly improve the overall efficiency of military decision-making.[12]

Russia's intervention in Ukraine revealed little that was network-centric in essence. However, there were experiments with network-centric warfare during Russian military operations in Syria, which most strikingly have shown an absence of massed artillery fires in favor of greater use of precision strikes and UAVs (Unmanned Aerial Vehicles) used for immediate bomb damage assessment (BDA). Nonetheless, most of the Russian operations in Syria have involved using non-precision guided weapons, and certainly network-centric based experimental operations constitute a much smaller fraction of the total.[13] It remains difficult, however, to gauge the extent of progress in this area, but the general picture of advancing toward fuller network-centric warfare capability is consistent with progress in areas such as C2 and especially in electronic warfare and the wider theme of "informationizing" the Armed Forces. Russian specialists anticipate continued progress in developing network-centric capability so long as the state continues to provide sufficient financial investment in this endeavor.[14]

During the formative period of Russian interest in and study of network-centric warfare, there were certainly skeptics among the top brass and in the mili-

11 Korchmit-Matyushov 2001; Parshin S.A., Gorbachov YU.Ye., Kozhanov YU.A. 'Sovremennyye tendentsii razvitiya teorii i praktiki upravleniya v vooruzhonnykh silakh SShA,' M.: LENAND, 2009 'Khochesh' mira, pobedi myatezhevoynu! Tvorcheskoye naslediye,' Ye.E. Messnera/russkiy voyennyy sbornik, No.21, 2005; Slipchenko V. I., 'Voyny novogo pokoleniya: distantsionnyye i beskontaktnyye,' M., OLMA-PRESS obrazovaniye,' 2004; Gareyev M.A., Slipchenko V.I, 'Budushchaya voyna,', M., OGI, 2005; 'Setetsentricheskaya voyna. Daydzhest po materialam otkrytykh izdaniy i SMI,' – M. VAGSH VS RF, 2010.

12 Dobykin/Kupriyanov/Ponomarov/Shustov 2007; Paliy 2006; Radziyevskiy 2006; Tsvetnov/Demin/Kupriyanov 1999; Tsvetnov/Demin/Kupriyanov 1998; Chernavin 1990; *Entsiklopediya 'Oruzhiye i tekhnologii Rossii. XXI vek'* Tom 13, '*Sistemy upravleniya, svyazi i radioelektronnoy bor'by.*'

13 Tikhanychev 2016.

14 Author interviews with Russian SMEs, December 2016.

tary scientific community. As with many other nations' military theorists, Russian military theorists writing in the post-1992 period can be divided loosely into three groups: traditionalists, modernists and revolutionaries. The traditionalists generally argued in favor of conservative approaches to warfare, stressing the continued need to study the Soviet experience of World War II while trying to adapt this to modern conflict settings. Modernists favored a modification of this approach that would allow general modernization of the doctrine, tactics and weapons and equipment inventory to suit modern conflicts that Russia might face, while revolutionaries argued that new approaches and schemes were needed and were open to a complete overhaul of the Armed Forces.[15]

These areas could often overlap; chief among the traditionalists was the late Army General Makhmut Gareev, widely recognized as the greatest Russian military theorist of his time. Gareev was highly skeptical of US advances in network-centric warfare and argued against its adoption in Russia.[16] However, with the onset of the reform of the Armed Forces in 2008, the modernizers and revolutionaries gained the ascendency in the extent to which the Defense Ministry, top brass and political leadership paid attention to introducing C4ISR and developing a credible network-centric warfare capability.[17] This has softened somewhat under Sergei Shoigu (appointed Defense Minister in November 2012) but the political-military leadership remains committed to building network-centric warfare capability and modernizing the Armed Forces along C4ISR lines. This complex theoretical context presents multiple sources of contradiction and makes the longer-term shape of Russian military capability difficult to forecast.[18] Gareev, for example, frequently spoke or wrote against C4ISR and this meets with varying degrees of approval from the political-military leadership. Forecasting how this process will transform Russia's conventional capability is impossible, but there are indications that they are willing to continue investing in the process of further modernizing the forces and systems along information-based lines. It is unclear where this will take the Armed Forces in the next decade and beyond, yet the top brass is evidently entertaining substantive change that will eventually result in a capability level that is far beyond the currently embryonic state.[19]

These efforts are also sensitive to Russian military traditions and culture, and the transformation in progress has to be considered in this distinctive historical and cultural setting. The network-centric capability transformation is not about copying or mirroring the US and leading NATO militaries, since it is unlikely to fit well with the Russian system. Moreover, Russian military terms, as already observed, do not quite fit or complement how such Western terms are used.

15 Bukkvoll 2011.
16 Gareev 2010a; Gareev 2010b.
17 Gavrilov 2010.
18 Stolyarevskiy/Sivoplyasov 2016.
19 Melkov/Zabuzov 2010.

The Russians do not generally think in terms of C4ISR in the way US or NATO militaries would. In Russian military parlance, since the 1990s the key developmental and conceptual terms have been: reconnaissance-strike complex (*razvedyvatel'no-udarnnyy kompleks* —RUK) and the reconnaissance-fire complex (*razvedyvatel'no-ognevoy kompleks* —ROK). In the early 2000s, Russian military scientists added the reconnaissance-strike system (*razvedyvatel'no-udarnnyy sistema* —RUS), the reconnaissance-fire system (*razvedyvatel'no-ognevoy sistema* —ROS), and the reconnaissance-fire operation (*razvedyvatel'no-ognevoy operatsiya* —ROO) to augment the RUK and ROK concepts. By 2009, two additional concepts were added: the information-strike system (*informatsionno-udarnaya sistema* —IUS) and the information-strike operation (*informatsionno-udarnaya operatsiya* —IUO).[20] While these are variants of the C4ISR approach, there is in fact no Russian equivalent of network-centric warfare, and so when they use the term it is first and foremost in reference to observing and analyzing such developments in the US and NATO, and China contexts, or more recently in grappling with its adoption in the Russian setting.

In the writings of Russian military scientists, there is very deep understanding and body of knowledge on Western approaches to network-centric warfare, with analysis of the operational experience of such operations and conclusions concerning the relative strengths and weaknesses of such approaches. Additionally, Russian specialists have also sought to study and draw lessons from examples of Western militaries, such as in Sweden, which tried and later abandoned efforts to introduce network-centric warfare capability – in order to avoid similar pitfalls in Russia. Russian analysis of US/NATO network-centric warfare is also closely linked to how its officers follow, assess and understand the concept and the key trends involved. Chief among these, clearly with permission to publish some of his analyses publicly, is GRU Colonel Aleksandr Kondratyev.[21]

Kondratyev's writings were most frequent in the period 2009-13. During this time, it also became evident that although there is very clear understanding of network-centric warfare among other Russian military scientists there is in fact no equally elaborated Russian variant of the concept.[22] In other words, it remains unclear in the work of the country's leading specialists in this area as to how precisely the concept is adopted, adapted and applied in the Russian context.[23]

Despite these issues, the idea of network-centric warfare has been preserved as one of the key drivers in the conventional military modernization.[24] For the top brass and defense planners in Russia, this means they rely upon

20 Razin'kov/Reshetnyak/Chernyy 2015; Yevdokimov et al. 2016; Osipov/Kolesnichenko/Tseplyyayev 2015.

21 Kipp 2010.

22 Kondratyev 2009a; Kondratyev/Medin 2009; Kondratyev 2009b.

23 Kondratyev 2009c; Kvochkov/Martsenyuk 2002.

24 Donskov/Golubev/Mogilev 2015.

"learning by doing," and therefore pay closer attention to the experimental use of networked operations in the Syrian theater to better understand how this may be furthered in future planning and subsequent shaping of the internal military structures and subsequent modernization priorities.

Indeed, recent work by Russian military theorists acknowledges that the adoption of network-centric capability in Russia's Armed Forces will involve a change in the outlook of the military leadership at all levels. This will entail forming the automated infrastructure, operating in a single information space, further developing modern means of surveillance and reconnaissance to fill the modernized telecommunications networks, and providing the Armed Forces with a "sufficient number of high-precision weapons."[25] Clearly, this involves long-term and systemic work on the part of Russian defense planners to integrate combat platforms into such an information network, accommodating such change to commensurate measures related to military manpower and training.[26] Such processes are heavily influencing and transforming approaches toward military decision-making.

Thus, following several years of experimentation with network-centric approaches and what this means for force structure, education, training and operational tactics, Russian top brass and theorists seem in broad agreement that this concept in the Russian context may be used to inspire, shape and drive the defense industry's work to modernize the country's Armed Forces. Network-centric is not seen as an end in itself, avoiding what some theorists describe as a "mental trap," but as a method to achieve a "factor of power" in the state's future warfighting capability.[27]

1.2 The Constituent Elements of the Military Decision-Making Apparatus

As regards the Russian military decision-making process, it is necessary to understand the distinctive culture and military traditions of the country's Armed Forces in order to recognize the extent to which this process does not simply mirror US approaches or NATO methods of conducting the MDMP. In the Russian context, the roles played by certain structures are important, as well as the significance of personality and the abilities and competences of commanders in the field. First, the constituent parts of the reformed Russian military chain of command for combat operations must be outlined, since it is in this context that the Russian MDMP is also conducted. This framework for the overall approach to military decision-making has emerged over the past decade as Moscow conducted widespread structural reorganization of the Armed Forces and its C2. As noted, this is designed to improve efficiency and speed in C2, as well

25 'Iranskiy BLA, Khamashekh vpervyye prinyal uchastiye v uchebnykh manevrakh KSIR,' *Voenno-tekhnicheskoe sotrudnichestvo*, April 2016; Litovkin 2016.

26 Isayenko 2015.

27 Kovalov/Malinetskii/Matviyenko 2015.

Fig. 0: Russian Joint Strategic Commands.

as to position the Armed Forces to conduct operations in an information-driven operational environment.

A three-tiered simplified C2 structure was trialed in June 2010 with a declared target of forming four new Military Districts/Joint Strategic Commands (*Obyedinennyye Strategicheskoye Komandovanie* –OSK) by December 1, 2010. The new districts/commands were formed on four strategic axes: West (headquarters in St. Petersburg), East (headquarters in Khabarovsk), Central (Yekaterinburg) and South (Rostov-on-Don). West MD/OSK was based on the Moscow and Leningrad MDs, and the Baltic and Northern Fleets. East MD/OSK comprised the former Far East MD, the eastern part of the Siberian MD, and the Pacific Fleet. Central MD/OSK included the western part of the Siberian MD and the Volga-Urals MD, while South MD/OSK encompassed the North Caucasus MD, the Black Sea Fleet, and the Caspian Flotilla.[28] In April 2019, the Defense Ministry set the target of December 2019 to upgrade the status of the Northern Fleet to that of an OSK.[29]

These command elements are essentially dual hatted, drawing from Western, Southern, Central, and Eastern MDs/OSKs. On December 1, 2015, a fifth OSK was formed: the Northern OSK. Also, by December 1, 2014, a new integrating structure was formed in Moscow: the National Defense Management Center (*Natsional'nyy Tsentr Upravleniya Oboronoy*—NTsUO), (see fig. 1[30]) aimed at in-

28 Maslov 2010.

29 Ramm/Kozachenko/Stepovoy 2019a.

30 This graphic is based upon one shown in Norberg/Westerlund 2016: 27. The original graphic does not depict the National Security Council, which consists of various military officers and civilian ministry and agency heads. These members of the National Security Council serve in senior positions at the operational and strategic levels in the boxes shown above.

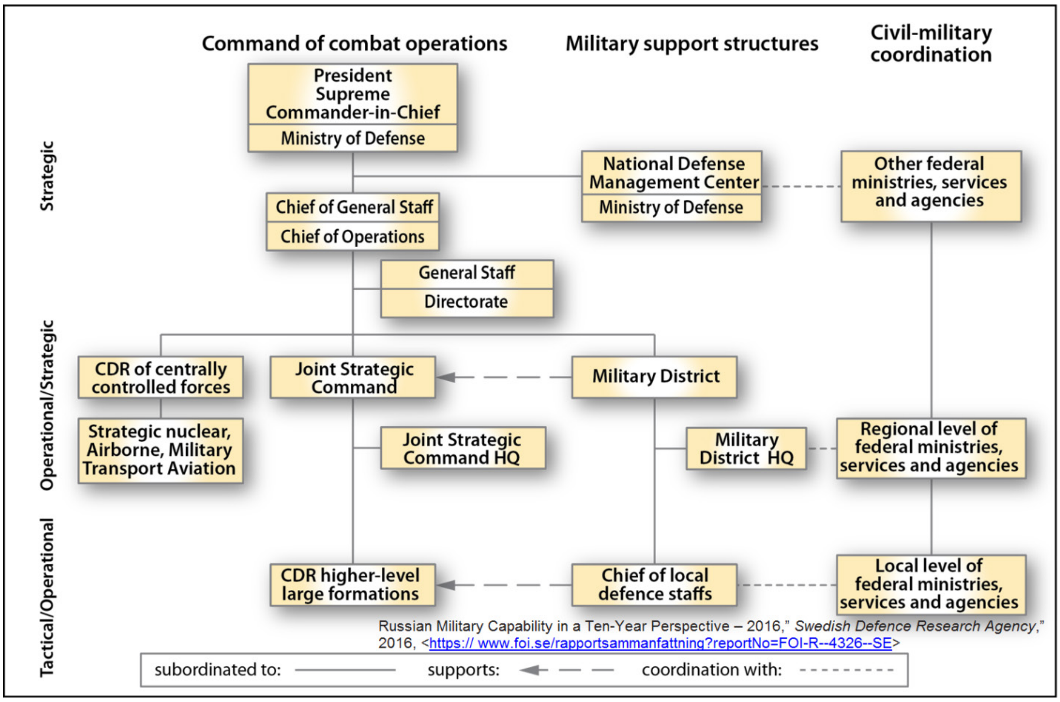

Fig. 1: The Assessed Chain of Command for Combat Operations (based on Norberg/Westerlund 2016: 27).

ter-connecting the leadership and direction of defense and security structures in real time.[31] In peacetime, these commands function as MDs and transition to OSKs during military operations. High command elements of the Ground Forces, Aerospace Forces (*Vozdushno Kosmicheskikh Sil*—VKS), as well as the Navy are in effect structural subunits of the General Staff, and the command process was simplified by reducing the number of stages orders pass through from sixteen to five.

The NTsUO will eventually be fully connected to subordinate command centers, linking strategic-operational and tactical levels; this will likely be implemented by 2027, with further technological refinements to follow. It will link the OSKs and Army Group levels.[32] At tactical levels, the Ground Forces are over-

31 "Natsional'nyy tsentr upravleniya oboronoy RF zastupit na boyevoye dezhurstvo 1 dekabrya, [The National Defense Management Center of the Russian Federation will take up combat duty on December 1]," TASS, 26 October 2014, http://tass.ru/armiya-i-opk/1533288.

32 Ostroovskiy/Sizov 2016. For the purposes of this article and clarity, the term "Army Group" is defined as a ground-based operational-level command (Combined Arms Army, Tank Army or Army Corps), typically smaller than a US Army Corps, that functions as an intermediate command between a Joint Strategic Command (OSK) or Fleet and tactical divisions and brigades. The authors have been unable to obtain a current definition for this term and its exact relation to Combined Arms Army, Tank Army, and Army Corps. But older definitions make it clear that the Army Group was an ad hoc formation, and more recent use of the term implies it is equivalent to the aforementioned ground-based operational-level commands (usually in a wartime posture). The term Army Group (Armeyskaya Gruppa) should not be confused Group of Armies (Gruppa Armiy), as the latter term refers to a much larger formation, a grouping of Field Armies.

coming automated C2 problems and implementing network-centric warfare capability through a variety of new technologies including new tactical radios, a tactical digital mobile subscriber system (military digital cell phone and data system), tactical laptops and tablets, and a secure military internet. This broadly fits the procurement and modernization priorities into a much broader network-centric framework.[33]

In terms of the changes made to the MD/OSK system, the role of the commander of the MD/OSK has been greatly boosted. The commander of the OSK during combat operations has control over all military and uniformed services in the OSK, apart from strategic level assets placed under the General Staff such as the Airborne Troops (VDV) or GRU Spetsnaz. In addition to this change, the introduction of the NTsUO is also important, as it brings together many of the key decision makers to interact in real time and oversee, guide and fine-tune the MDMP. It is, no doubt, calculated to aid network-centric approaches to combat operations, but it remains a work in progress and will take time to fully integrate all the various nodes in the Russian military system. The NTsUO is also doubtless intended as a means to overcome the traditional stovepiping in the Russian military decision-making system, but it will also take time and effort to overcome institutional inertias.

The roles of the General Staff and the Russian Security Council as elements, at times indirectly, influencing the overall architecture for military decision-making are outlined in the following excerpt, examining how Russia might create a framework to conduct large-scale military operations.[34]

> In the Russian system, the General Staff is responsible for operational-strategic level planning. Russia has a fairly nuanced view of the differences between the tactical, operational, and strategic levels of military science. The difference between these levels is based upon the scope of mission, not simply the size of the unit. For example, a brigade fighting under an Army Group would be considered a tactical asset, but the same brigade fighting independently in a

33 'Ukazatel' Statey, Opublikovannykh V Zhurnale 'Morskoi' Sbornik' *Morskoi' Sbornik*, No. 12, 2015.

34 In Russian usage, the term "large-scale warfare" refers to warfare on the scale of World War I and World War II. When describing conflicts on a lesser scale, the expression "local wars and armed conflicts" [локальных войнах и вооруженных конфликтах] is regularly used. This expression has been used for a wide variety of conflicts including the Korean War (1950-1953); the five Arab-Israeli Wars (1948-1982); the Vietnam War (1964-1973); the Iran-Iraq War (1980-1987); the Persian Gulf Wars (1990-1991, 2003 onwards); the Afghanistan Wars (1979-1989, 2001 onwards) and the Chechen Wars (1994-1996, 1999-2005). Given this view, the Russian definition of "local wars and armed conflicts" encompasses military activities from the level of what would be considered counter insurgency (COIN) operations through the level of state-on-state conflict, up to and including, much discussed Western notional scenarios where Russia and NATO become engaged in some sort of limited armed conflict regarding the Baltics. Although we have attempted to keep with Russian definitions and perspectives as much as possible, for purposes of clarity, in this instance we use a more Western definition of "large-scale warfare", which can roughly be defined as any state-on-state military conflict.

> different situation could be considered a tactical-operational asset. Generally speaking, the General Staff's operational planning duties typically involve the operational and operational-strategic level, or, in Russian parlance, "operational art." Proponency for strategic planning resides with the Russian Security Council, which is an interministerial body that is chaired by high-level officials, weighted heavily with the intelligence and security services. Although the Russian Security Council is the chief proponent of Russian strategy, the Chief of the Russian General Staff does sit on council, bridging operational art to the national security strategy.[35]

It should be noted that it is equally important to understand what the General Staff does not do. It has no operational control over forces. Operational control was removed from the service chiefs and placed in the hands of the OSK commanders. Therefore, in combat, war-fighting assets are under the control of the appropriate field commanders rather than the General Staff.[36] Thus, the role of individual commanders in the Russian MDMP is more pronounced than in Western militaries.

2 Strategic, Operational and Tactical Levels

2.1 Strategic, Operational and Tactical Levels and the NTsUO

Many of these structural themes and unique aspects of Russian military approaches to the reformed C2 system feed directly into the Russian variant of the MDMP. There is close linkage between these structures and the focal point of commanders within the system across strategic, operational and tactical levels. In short, the Russian MDMP seems predicated on the commander being competent and having strong leadership skills, supported by a relatively small staff. In this system and within the Russian variant of the MDMP, the issue of the personality of the commander in the field, and at strategic levels the OSK commanders, plays a highly significant role. It is also clear that in the future the NTsUO will play an increasingly crucial role in smoothing out some of the problematic issues involved in automated C2, and in efforts to integrate and streamline the issues facing the future development of the MDMP.

In terms of C2 at strategic level, the Commander-in-Chief will most likely play a critical and "hands-on" role. This might change in the future in the aftermath of the Putin era, but it seems the system in which the overall Russian MDMP occurs is designed to be "top heavy" and is unlikely to change in the foreseeable future. A good illustration of this was offered by Army General Valeriy Gerasimov, the Chief of the General Staff (CGS), noting that in terms of Russia's military operations in Syria, Putin had involved himself in the planning on a very regular basis, as well as in setting operational aims. Asked about Putin's in-

35 Bartles 2019: 56.

36 Ibid.

volvement, Gerasimov said: "I usually report to the Minister of Defense on a daily basis morning and evening on the state of affairs and the progress in mission performance, and he reports to the President. Once or twice a week, the minister reports to the president in person, presenting the requisite documents, maps, and video materials. Sometimes the Supreme Commander-in-Chief himself comes to see me, sometimes the Defense Minister and I go to him to report. The President identifies the targets, the objectives, he is up to speed on the entire dynamic of the combat operations. And in each sector, moreover. And, of course, he sets the objectives for the future."[37]

An additional "work in progress" already alluded to is the theme of fuller integration of C4ISR and automated C2 to produce a more joined-up approach toward planning and coordinating military operations. Here a significant role is assigned to the NTsUO, which, as more technologies are introduced and flaws in the "stovepiping" are resolved, will play an enhanced role in overseeing operations in real time. The interface between the national political leadership, General Staff, Defense Ministry and OSKs down to temporary mobile HQs during operations would be the NTsUO. Next in the chain is the OSK leadership, which means that during wartime the OSK commander has overall control of military forces within his OSK, including the non-Defense Ministry forces, except for some strategic assets under General Staff control (such as the Strategic Rocket Forces (RVSN), Airborne (VDV), and GRU Spetsnaz units). Then, next in the order of command would be the assets under the command of the OSK. In terms of the Western MD/OSK, for example, this is the 6th and 20th Combined Arms Army and the 1st Tank Army.[38]

The recent history of Russia's operational-strategic exercises reveals that great emphasis is placed upon internal strategic mobility, and so it is highly likely that units would move from other OSKs in a pre-conflict phase. Equally, there is almost no possibility of the General Staff attempting to use the approach seen in south-eastern Ukraine, to assemble forces for large-scale conflict, for two critical reasons. First, the operational environment would differ as the adversary also differs in scope and capability, and the use of Battalion Tactical Groups (BTGs), which Russia's General Staff associates with local wars and armed conflicts, is not the tactical means to be used in large-scale inter-state warfare. That is to say, the structure would be: OSKs-Army Groups-divisions/regiments and brigades, and it would not focus on BTGs. The BTGs are not intended for use in this level of operation.[39] The flexible Army Groups with their

37 Baranets 2017.

38 Vladykin 2017;n Dragomirov 2017; "Sily PVO Zapadnogo voyennogo okruga razvernulis' v novykh rayonakh na ucheniyakh Zapad-2017 [Air Defense Forces of the Western Military District deployed in new areas at the West-2017 exercises]," TASS, 16 September 2017, http://tass.ru/armiya-i-opk/4567491, last accessed on 01 February 2020; 'Baltic Fleet corvettes destroy air, sea and coastal targets during Zapad-2017 drills,' TASS, September 17, 2017.

39 Popov, 'Faktor mobil'nosti v sisteme boyevoy gotovnosti Vooruzhennykh Sil," Op. Cit.

tactical maneuver assets (divisions and brigades) would be the main constituent parts of the *obyedineniya*.

Western and Russian analyses of the operational-strategic exercise Vostok 2018, for example, tended to be somewhat overshadowed by Moscow's decision to invite China to send forces to the exercise. However, in referring to the 2018 *operativno-strategicheskie ucheniya*[40], CGS Gerasimov used the phrase *strategicheskiye manevry* (strategic maneuvers), adding that Russia needs more of these exercises. It is unclear how he understood the elevation of terms or whether the Chinese People's Liberation Army (PLA) presence served as the reason to claim a "new level" in the annual exercise.[41] Vostok 2018 focused on five combined-arms and four air defense training grounds in the Eastern and Central MDs/OSKs. It also involved the VKS, VDV, and the Northern and Pacific Fleets. The Commander of the Central MD/OSK, Lieutenant-General Alexander Lapin, noted the "unprecedented" scale of the exercise would entail "new forms and methods of combat" based on lessons drawn from Russia's operations in Syria, but he made no mention of the rehearsal of large-scale inter-state warfare though clearly it featured in the exercise.[42]

Gerasimov provided an outline of the scenario. The exercise was held from September 11-17, with the first two days devoted to planning. The second active phase was staged over five days, and its novelty lay in extending the exercise beyond one MD/OSK to include both the Eastern and the Northern Fleet OSK, as well as the participation of the PLA. The General Staff appears to use such strategic level exercises to assess, among other features, the speed and efficiency of the MDMP. The main action would still focus on combined-arms training grounds in the Eastern MD, at four VKS and air defense training facilities, and in the Okhotsk and Bering Seas. Again, highlighting the scale of the exercise, Gerasimov noted the presence of advanced weapons systems such as the Iskandar operational-tactical system. He said in the second active phase of the exercise repulsion of a "massive air strike" would be rehearsed alongside repelling cruise missile attacks involving VKS air defense and naval platforms in the Sea of Okhotsk and the north western Pacific Ocean. The exercise also envisaged conducting offensive and defensive operations using land, air, and sea power. The joint operations conducted with the PLA at the Tsugol training

40 The terms *operativno-strategicheskikh ucheniy* (operational-strategic exercise) and *strategicheskiye komandno-shtabnyye* (strategic command staff [exercise]) are frequently used interchangeably in Russian military literature, though the latter implies fewer forces used or deployed for the exercise.

41 "V Rossii podoshla ochered' provodit' strategicheskiye manevry, zayavil Gerasimov [In Russia, the turn has come to conduct strategic maneuvers, said Gerasimov]," RIA Novosti, September 9 2018, https://ria.ru/defense_safety/20180906/1527948289.html, last accessed on 01 February 2020..

42 "V masshtabnom uchenii Vostok-2018 budut zadeystvovany osnovnyye sily Tsentral'nogo voyennogo okruga, [The large-scale Vostok-2018 exercise will involve the main forces of the Central Military District]," Rambler.ru, 30 August 2018, https://news.rambler.ru/middleeast/40685993-v-masshtabnom-uchenii-vostok-2018-budut-zadeystvovany-osnovnye-sily-tsentralnogo-voennogo-okruga/, last accessed on 01 February 2020; Sergeyev 2018.

ground rehearsed combined-arms action against a hypothetical opponent; this response was coordinated among Russian forces, PLA and a small number from Mongolia. A complex range of targets reportedly allowed commanders to form a "front" 24 km in length and 8 km deep.[43] On the basis of this detail, some analysts conclude that Vostok 2018 was a rehearsal for large-scale warfare. Yet, it also fits a series of conflict types built into an overall scenario to rehearse conflict escalation control.

Such exercises illustrate Russian approaches to strategic, operational and tactical levels of combat operations, and afford insight into how they seek to assemble these in accordance with the requirements of the exercise scenario vignettes. While the Russian General Staff avoids applying models to its operational planning and this is represented in its military exercises, they also believe that the US and NATO do conduct operations based upon templates. In general, US/NATO line-block methodologies and paradigms such as PMESII-PT (Political, Military, Economic, Social, Infrastructure, Information, Physical Environment, and Time) are seen as constraining by Russian operational planners, as they are perceived to channelize thought, generally being evidenced in poor staff work.[44] Perhaps General Valery Gerasimov, Chief of the Russian General Staff, makes this point best when he quotes Aleksandr Svechin: "It is extraordinarily hard to predict the conditions of war. For each war it is necessary to work out a particular line for its strategic conduct. Each war is a unique case, demanding the establishment of a particular logic and not the application of some template."[45] From a Russian perspective, this may explain why the US has recently had some brilliant tactical successes in Afghanistan, Iraq, and Syria, but has failed to turn these tactical successes into beneficial strategic outcomes.

In a similar vein, they see the US/NATO MDMP as fixed and easy to predict in terms of its stages and possible weaknesses. This is evident in Russian military coverage of NATO operations and the interest in countering a massive air attack/campaign; this is factored into most Russian operational-strategic exercises, with emphasis on countering cruise missile attacks and responding to air sorties.[46] Moreover, when the Russian Ground Forces and other arms and branches of service train to fight they have an enemy in mind. Unlike the US military, which is capability based, the Russian Ground Forces are combat

43 Dragomirov 2018; Kramnik 2018.

44 Author interviews with retired Russian military officers, Moscow, November 20, 2019.

45 General Valery Gerasimov, "Tsennost' nauki v predvidenii: Novyye vyzovy trebuyut pereosmyslit' formy i sposoby vedeniya boyevykh deystviy [The value of science is in the foresight: New challenges demand rethinking the forms and methods of carrying out combat operations]," *Voyenno-Promyshlennyy Kurier*, 26 February 2013, http://vpk-news.ru/articles/14632. The quote was taken from Robert Coalson's English translation of Gerasimov's article, available at: https://www.armyupress.army.mil/Portals/7/military-review/Archives/English/MilitaryReview_20160228_art008.pdf, last accessed on 16 October 2020.

46 Vladykin 2017. "Pochemu 'Zapad-2017' vyzval isteriyu na Zapade, [Why 'Zapad-2017' caused hysteria in the West]," *Nezavisimoye Voyennoye Obozreniye*, 8 September 2017, http://nvo.ng.ru/gpolit/2017-09-08/2_964_nvored.html, last accessed on 01 February 2020. Dragomirov 2017.

trained to fight based on the General Staff's assessment of the likely threats to the Russian state. This is likely to give the Russian Ground Forces a long-term training edge over their American and NATO counterparts, as well as strengthen their conviction that conflict will only occur close to Russia's borders.[47]

Following Vostok 2018, a command-staff exercise was held in October 2018 in the Southern OSK featuring large-scale force-on-force maneuvers. The exercise featured elements from the 8th, 49th, and 58th Combined Arms Armies, the 22nd Army Corps, the Caspian Flotilla, the Black Sea Fleet, the 4th Air Force and Air Defense Army, military units subordinate to the Southern OSK as well as some Spetsnaz units. Colonel-General Aleksandr Dvornikov, the Commander of the Southern MD/OSK stated: "For the first time in exercises of this level, the opposed forces principle was implemented, in which troops in two operational directions conducted combat operations against each other. ... Prior to the command-staff exercise, the troops of the military district conducted just company and battalion tactical exercises." The exercise, as a rehearsal for large-scale force-on-force warfare, did not feature the use of any BTGs, but instead rehearsed operations using divisions/regiments and brigades on opposed sides. The General Staff also decided to use units to oppose each other rather than forming a notional opposing force to represent the adversary.[48] And, again, with such an emphasis placed upon training for large-scale conflict, there is no doubt that this exercise was used to test, refine and experiment with the MDMP.

2.2 Military Planning and the Russian MDMP

The likely development of the Russian Armed Forces' conventional capability to 2027, providing that sufficient levels of defense spending may be maintained

47 Morenkov/Tezikov 2015. Kuptsov 2011: 10–17. Balagin 2016. "S-500 Prometheus," Missile Threat, http://missilethreat.com/defense-systems/s-500/, last modified April 26, 2013; "S-500 budet sposobna odnovremenno porazhat' 10 ballisticheskikh tseley s pochti pervoy kosmicheskoy skorost'yu – glavkom VVS [The S-500 will be able to simultaneously hit 10 ballistic targets at a speed approaching first cosmic velocity' - Air Force Commander]," TASS, 24 December 2012, http://tass.ru/politika/654566, last accessed on 01 February 2020. "ZRK S-400 "Triumf:" obnaruzheniye – dal'neye, soprovozhdeniye – tochnoye, pusk – porazhayushchiy [S-400 'Triumph' SAM: detection - long-range, tracking - accurate, launch – striking]," 3 June 2008, Vozdusho-Kosmicheskaya Oborona, http://www.vko.ru/oruzhie/zrs-s-400-triumf-obnaruzhenie-dalnee-soprovozhdenie-tochnoe-pusk-porazhayushchiy, last accessed on 01 February 2020.

48 "Soyedineniya armii Yuzhnogo voyennogo okruga (YuVO), dislotsirovannyye v Volgogradskoy i Rostovskoy oblastyakh prinimayut uchastiye v dvukhstoronnem komandno-shtabnom uchenii, [Army formations of the Southern Military District, deployed in the Volgograd and Rostov Regions, take part in a bilateral command and staff exercise]," 1 October 2018, Tvzvezda.ru, https://tvzvezda.ru/news/forces/content/201810011602-mil-ru-j6tgf.html, last accessed on 01 February 2020. "Chetyre divizionnykh i brigadnykh takticheskikh ucheniya proydut v ramkakh KSHU sgruppirovkami voysk YuVO [Four divisional and brigade tactical exercises will be held within the framework of the command-and-control college with the groupings of troops of the Southern Military District]," Ministry of Defense of the Russian Federation, 18 September 2018, https://function.mil.ru/news_page/country/more.htm?id=12195952@egNews.M, last accessed on 01 February 2020.

in this period, envisages greater force integration and adoption of C4ISR capability, with an array of related capabilities including precision-guided weapons, cyber and EW (electronic warfare). This has clear implications for the future development of C2, automated C2, as well as the challenges for commanders in coordinating and executing the MDMP. As noted, the General Staff has factored into the operational-strategic military exercises the concept of fighting a large-scale inter-state war. But how does this differ from the Soviet approach involving multiple echeloned armies and fronts, and what might these differences mean given the need for the General Staff to plan operations according to the specific demands of the local operational environment? In 2017, Major-General Sergey Batyushkin (retired) published *Podgotovka i vedeniye boyevykh deystviy v lokal'nykh voynakh i vooruzhennykh konfliktakh*, (Preparation and Conduct of Military Actions in Local Wars and Armed Conflicts).[49] This lengthy work offers detail on Russian approaches to military planning and is especially important for explaining the distinction between large-scale warfare and "local wars and armed conflicts" (*lokal'nykh voynakh i vooruzhennykh konfliktakh*).[50] Batyushkin reminds his readers that the Soviet Armed Forces were trained and prepared to fight a conventional war in Europe using means and methods including mass mobilization that will never be used again. He distinguishes, in terms of definition, local wars and armed conflicts from large-scale inter-state warfare, and in this regard, Batyushkin's work is important in showing how Russia's Armed Forces would approach operations other than large-scale conflict. It is highly likely that the MDMP in use varies according to the scale, nature and mission goals of any particular combat operation.

In an address to the Academy of Military Sciences in January 2016, the then Commander of the Southern MD/OSK Colonel-General A.V. Galkin discussed the challenges connected to C2 of integrated force groupings in a theater of military operations. He referred to the US DoD concept of "joint force," forming forces along with allies and civilian organizations to conduct operations on the ground, in the air, at sea and in the information space. Noting the term "global integrated operation," he also told his audience that a practical example of this approach began in August 2014 when the US and coalition partners deployed forces to the Middle East to combat the Islamic State (ISIL/ISIS). Galkin explained: "The basis for C2 systems is the global information network of the US Department of Defense, which supports all types of communications. Characteristically, due to this advanced communication system, the command and control points were deployed at a significant distance from each other on the territories of various states (Jordan, Iraq, Bahrain, Qatar)." In Galkin's view,

49 Major-General (ret.) Sergey Batyushkin graduated from the Frunze Military Academy (now called the Combined Arms Academy of the Armed Forces of the Russian Federation) with a prestigious 'gold medal' for academic excellence and was later an instructor at the institution. He is also a Doctor of Military Sciences, and a member of the Russian Academy of Military Science. Batyushkin's impressive credentials make him a suitable authority on these issues.

50 Batyushkin 2017: 438.

such developments compelled Russia's General Staff to revise its approaches to conducting operations. In passing, referring to NATO operations in Yugoslavia, Afghanistan and Libya he said that "now the application of military force is preceded by a long period of political, economic, and informational pressure with a gradual escalation to military conflict."[51]

During the same conference, similar C2 themes were addressed by Major-General I.A. Fedotov, senior researcher of the Center for Military-Strategic Studies of the General Staff Academy (TsVSI VAGSh). He prefaced his lecture by referring to defense sufficiency and its impact on forming force groupings: "In the new military-political and military-strategic conditions the demands of the principle of defense sufficiency (*oboronnaya dostatochnost'*) apply not to the Armed Forces in general, but only to the combat strength of the functional components, including force groupings (*gruppirovka voysk*) that are deployed along strategic axes to repel an attack and eventually destroy the enemy with the required level of effectiveness." Despite the enormous progress made in restructuring C2 and introducing automated C2 since the reform of the Armed Forces initiated in late 2008, General Fedotov attacked the limited nature of actual integration and castigated the persistence of stovepiping:

> In our view, one of the main reasons for the unsustainability of the current command and control system is the retention of stereotypes in the structural elements of command, which at one time were designed to conduct strictly defined tasks and consisted of four functional command stovepipes: joint force obyedineniya [i.e. Army Groups, Fronts, Strategic High Command], soyedineniya [i.e. army, division, or brigade] and combat units; soyedineniya-level units of the branches of arms [i.e. motor rifle, tank, artillery, air defense] and specialty branches [i.e. reconnaissance, signals, EW, engineers, NBC, logistics/supply] of the Ground Forces; branches of operational and combat support; and comprehensive support branches.
>
> In accordance with the approaches of that time to the forms of employing the Armed Forces, the system of front command and control was necessarily built up with command and control stovepipes (Air Force, Air Defense Forces, Navy in coastal or greater maritime areas) that carried out, in general, supporting roles in the interests of the Ground Force groupings.
>
> The command and control system was oriented toward detailed planning and control of a Ground Force grouping. Planning for the employment of, and command and control of force groupings of other branches (Air Force and Navy) was carried out by relevant commanders from their own command and control locations.
>
> Modern approaches to the forms of employing the Armed Forces are critical for the employment of a force grouping. The significant increase in the num-

51 General-Colonel A.V. Galkin, (Commander of the Southern Military District 2010-2016): Galkin 2016: 51–54.

> ber of tasks that are required of the command and control of joint actions of a force grouping in the theater of military activity along a strategic axis demands a correction of the structural levels of command and control.[52]

Apart from highlighting ongoing issues and challenges related to more fully integrating C2 to avoid the type of stovepiping still present within the overall C2 structures, Fedotov inadvertently outlines the approximate layout of a force grouping (*gruppirovka voysk*) that could be formed in any strategic direction. Therefore, large-scale inter-state conflict involving Russia's Ground Forces acting in concert with support from other branches and arms of service would involve: "joint force *obyedineniya* [i.e. Army Groups, Fronts, Strategic High Command], *soyedineniya* [i.e. army, division, or brigade] and combat units; *soyedineniya*-level units of the branches of arms [i.e. motor rifle, tank, artillery, air defense] and specialty branches."[53] Combined with Galkin's observation that the initial period of war includes a build-up and preparation phase, a rough picture emerges as to how the Russian General Staff would plan and a form a *gruppirovka voysk*, to include ground forces, for large-scale operations.

3 The Centrality of the Automated Command and Control Systems

3.1 Design, Introduction and Transition to Automation in C2

Russia's military decision-making architecture, and its approaches to this process at strategic, operational and tactical levels, is very much tied into the development in recent years of automated command and control systems, and the wider efforts in its military modernization to transition into the information era. The unifying theme in these efforts both to streamline the C2 system itself and to introduce automated systems, is the focus upon speed: speed in *decision-making* and speed of *action* in military conflict.[54] The Soviet Union, and later the Russian Federation, attempted to field a modern network-centric C2 system, though lack of the technical means to implement it resulted in many delays. This situation has changed rapidly in the last few years as Russia developed its information technology sector with military industries developing and fielding new technologies. Moscow, as noted above, has established a National Defense Management Center that will increasingly connect to subordinate command centers at the joint strategic command (military district) and Army Group levels.[55]

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52 Major-General I.A. Fedotov, senior researcher of the Center for Military-Strategic Studies of the General Staff Academy (TsVSI VAGSh): Fedotov 2016: 65–69.

53 Ibid.

54 Author's emphasis.

55 Ostrovskiy/Sizov 2016.

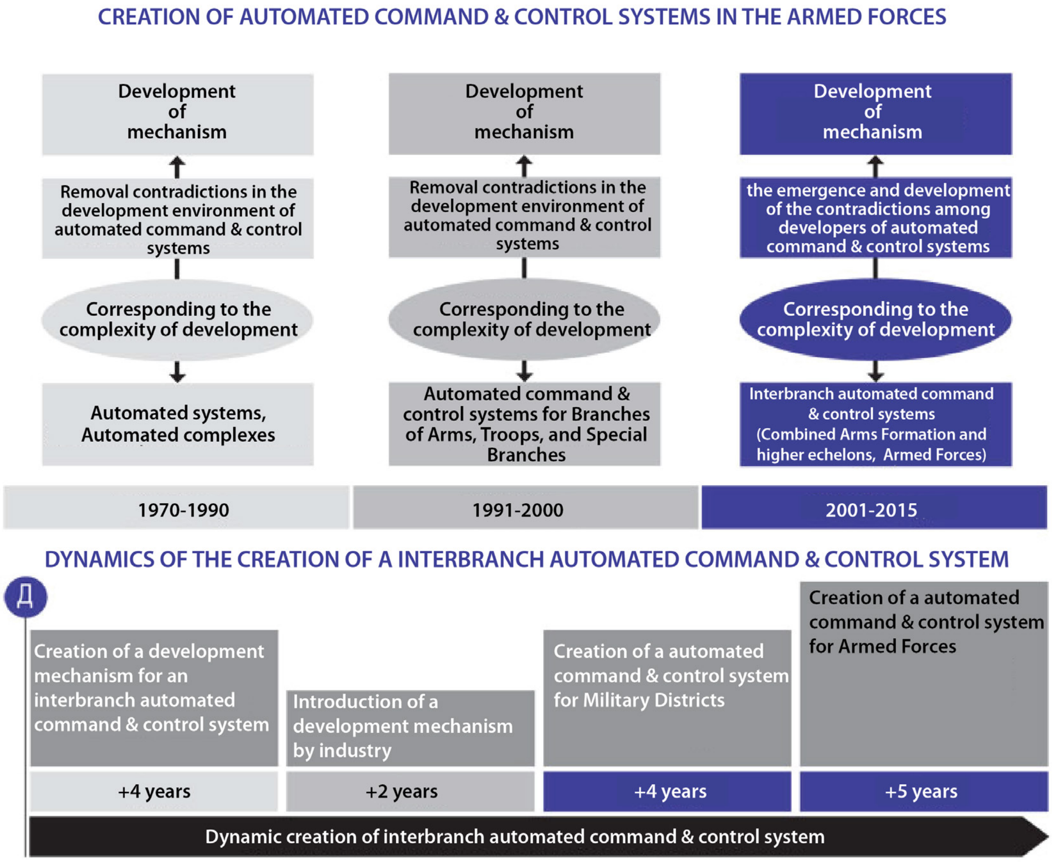

Fig. 2: Creation of the Interbranch Automated Command Control System (Ivanov 2015).

This complex process itself, marked by force restructuring and advances in military modernization, reached crisis point during the operational-strategic exercise Kavkaz 2012, after which the General Staff recommended terminating the contract with the group of defense companies tasked with the design and manufacturing of the automated command and control system. This triggered renewed political support for the scheme after the intervention of Deputy Defense Minister Dmitry Rogozin, permitting a stay of execution for their work in this area.[56] Since then, progress in this field has been marked and this trend seems likely to continue over the next decade and beyond. Kavkaz 2016, for example, demonstrated that significant progress had occurred in automated C2, with the signals chief reporting similar advances in further digitizing military communications systems.[57] But more than the technological advances involved, officers and enlisted personnel were evidently sufficiently well trained

56 McDermott 2012.

57 Interview with Major-General Aleksandr Viktorovich Galgash by General Staff Program Host Igor Korotchenko: Igor Korotchenko, "Armeyskiye brigady osnastyat 'Redutami' [They Will Equip Army Brigades with 'Redut']" Life, 23 October 2016, https://life.ru/t/звук/920740/armieiskiie_brighady_osnastiat_riedutami_novuiu_sistiemu_sviazi_obkatali_na_uchieniiakh, last accessed on 01 February 2020.

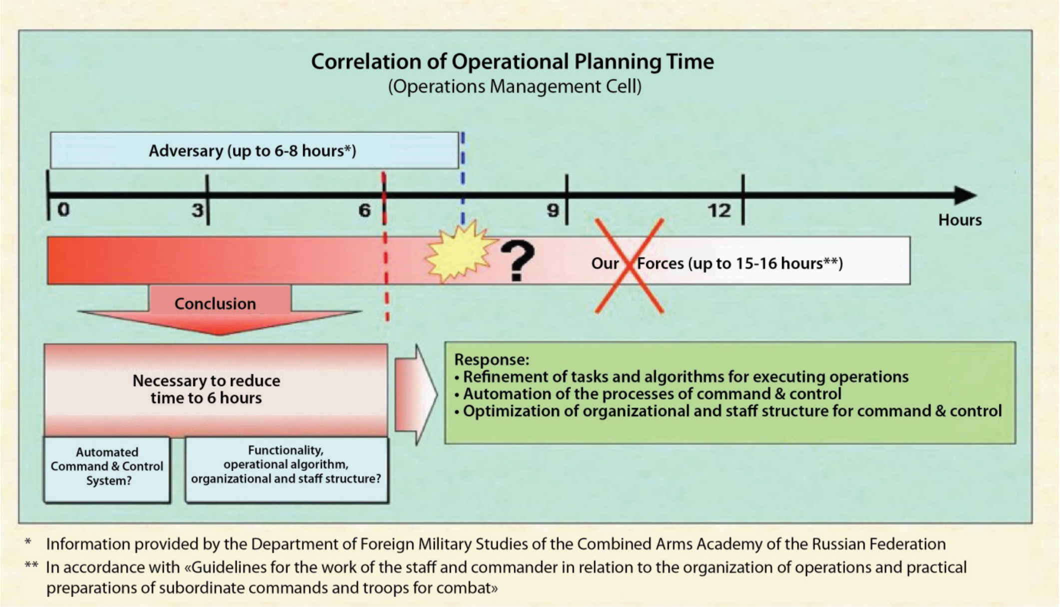

Fig. 3: Russian Operational Planning Time

in the system's use, indicating progress in the internal trend to build a force increasingly well versed in network-enabled systems and their uses.

Russia's theoretical interest in developing and fielding an integrated automated C2 dates from the early 1970s, and has progressed slowly since work on the system was finally ordered in 2000 (see fig. 2).

As figure 2 illustrates, this process has been long and arduous, but is not without ongoing issues. In 2000, President Putin ordered the Russian defense industry to design and develop a Unified System for Command and Control at the Tactical Level (*Yedinaya Sistema Upravleniya v Takticheskom Zvene*–YeSU-TZ). Since then this work has been carried out by Sozvezdiye Concern, which oversees the group of domestic defense industry companies pursuing this project.[58] The process intensified following the Russia-Georgia War in August 2008 and the ensuing military reforms which transitioned the Ground Forces to a brigade-based structure. The General Staff concentrated on enhancing the speed of military decision-making, which would be facilitated by the YeSU-TZ, and grappled with network-centric approaches tied to improving speed in other areas including strategic and tactical mobility. The base of the figure implies the failure of the process to result in a *fully* integrated system, and suggests time-frames and possible approaches toward fixing this issue (discussed in more detail below).[59]

Discussion among Russian military theorists, specialists in network-centric warfare and the top brass in the period 2008-12 focused largely on the need to

58 Metlitsky/Zaitsev 2008: 18–22; Perov/Pereverzev 2008.

59 Author's emphasis. See: Kandaurov 2010a; Kandaurov 2010b. A valuable an insight into characteristic flaws in Russian defense planning can be found in: Vendil 2009.

reduce the time needed to generate orders for the conduct of an operation.[60] They saw the YeSU-TZ as a means to close the gap to leading NATO militaries in this regard. The speed required at the very earliest phase in this process is illustrated in figure 3. The diagram is taken from a Russian military publication of 2013,[61] but shows how this thinking had been developing in this area since the General Staff carried out its lessons-learned analysis from the Russia-Georgia War in 2008; one of its main lessons related to the ineffective nature of the existing command, control and communications system.[62]

3.2 Problems in the Design and Introduction of the YeSU-TZ

Despite high-level support for such an ambitious technological transformation, and clear understanding within the General Staff concerning the overall importance of digitizing communications and fielding an integrated network-enabled command, control and communications system, in practical terms the defense industry struggled to meet this challenge. The crux of the design flaw problems with the YeSU-TZ stemmed from the failure of the top brass, commanders, Defense Ministry and defense industry to work together to coordinate these efforts. There were consequent issues linked to the design and the parameters of the system.

The YeSU-TZ was repeatedly tested at brigade level in Alabino, and also featured limited experimental usage during the annual operational-strategic exercises. On all occasions, its failures and numerous system-related issues were identified. In 2010, for example, tests at brigade level and in military exercises exposed the complex and overly detailed nature of the graphic displays in the hand-held or laptop devices for the officers or troops using the system, who complained that this rendered the system too difficult to use (it was not considered to be user friendly). Much more serious was the public admission of concern about the *survivability* of the system during combat.[63]

During this testing phase, the Defense Ministry and General Staff realized that part of the wider problem related to the need to train officers and contract personnel concerning the use and exploitation of the system. The training side was intensified in 2012 and further strengthened after the problems encountered during Kavkaz 2012. Progress in this area has proved to be quite rapid, and

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60 Vladimorov/Stuchinskiy 2016.

61 Blog site of Lieutenant General Sergei Skokov, former Chief of Staff of the Russian Ground Forces, "Otsenka obstanovki v voyennom dele - chast' vtoraya" [Assessment of the Situation in the Military - Part Two], http://general-skokov.livejournal.com/2691.html, last accessed on 27 November 2016.

62 Interview with CGS Makarov, *Voyenno Promyshlennyy Kuryer*, February 1, 2011; Oleg Falichev, "Preobrazovaniya zakoncheny, razvitiye prodolzhayetsya [Transformation is completed, development continues], *Voyenno-Promyshlennyy Kurier*, 31 January 2011, http://vpk-news.ru/articles/7058 General Aleksandr Postnikov, "Vremya 'avtomatizirovannykh' voyn [Time of 'automated' war]," *Nezavisimoye Voyennoye Obozreniye*, 14 January 2011, http://nvo.ng.ru/realty/2011-01-14/1_automate.html.

63 Author's emphasis. Kandaurov 2010c.

this will continue over the next few years as the number of contract personnel further increases. Kavkaz 2012 was a critical test for the Automated Command and Control System (*Avtomatizirovannyye Sistemy Upravleniya*—ASU). Unfortunately, the system's numerous flaws were exposed during this exercise, with a report submitted to the General Staff elaborating more than 200 of them. The General Staff recommended that the Defense Ministry should terminate the contract for the YeSU-TZ and instead opt for an alternative, which was still in its early design phase. Rogozin succeeded in preserving the existing arrangements based on giving the defense industry time to fix the problems. Among the 200 plus flaws identified by testing the ASU during Kavkaz 2012, 160 were attributed to human error, and the remaining technical issues had to be resolved by Sozvezdiye Concern. Since the number of human error issues was so high, it led to re-prioritizing training and education in the use of the system. The target for the defense industry was to iron out the remaining technical issues and begin supplying the YeSU-TZ to the Armed Forces by 2015.[64]

The effort to introduce the ASU into the Russian Armed Forces is well advanced, but the systems, or 'brigade sets' are so expensive with all their component elements that costs of introducing this for one brigade is estimated to be 8 billion rubles ($123 million) with an annual capacity of equipping three brigades. In terms of integration of the overall ASU, an additional issue is that services and arms can actually have an altogether different automated system. For example, the Airborne Forces (VDV) have the automated 'Andromeda-D' system, specifically tailored to meet their operational needs, which they believe means they will be able to exercise command and control over the future Armata-based platforms when these are finally procured by the Defense Ministry.[65]

These automated systems also differ between the Ground Forces, VKS, VDV and Naval Infantry, and this presents ongoing challenges in terms of linking all these to new or modernized platforms and digitized communications systems. Although Russian specialist critics of network-centric warfare highlight the failure to create a fully integrated automated system, the trends in addressing the issues involved, which has picked up pace in the past few years, suggests that new generation systems will likely be sufficiently integrated in the period 2025-30. The Armata, Bumerang, and Kurganets platforms for the Ground Forces are classified as Ground Troops vehicles and will also have their own Tactical Echelon Integrated Command and Control Systems, further complicating an already complex automatized system. *Arsenal of Fatherland* Magazine Editor-in-Chief Viktor Murakhovskiy highlights the nature of the problem: "But there are tactical situations when airborne troops are accomplishing combat

64 Author discussions with Russian SMEs, December 2016.

65 Coverage in RIA Novosti, 'Tsentr 2015,' *RIA Novosti*, 19 September 2015, https://ria.ru/trend/exercise_centre_russia_19092015/, last accessed on 01 February 2020. Vladykin 2015a. Vladykin 2015b. "V khode ucheniy Tsentr-2015 voyska REB otrabotayut naneseniye radioelektronnogo udara, [In the course of the Tsentr-2015 exercises, the EW troops will work on electronic strikes]," Vesti.ru, 15 September 2015, http://www.vesti.ru/doc.html?id=2664568, last accessed on 01 February 2020.

missions jointly with the motorized riflemen and tank crews. Therefore, unit and subunit commanders must coordinate with each other and receive the needed information in the full amount regardless of whether they are using Andromeda or the Tactical Echelon Integrated Command and Control System YeSU-TZ."[66]

Despite these issues, the testing of the ASU complexes during Kavkaz 2016 was deemed by the Defense Ministry and the General Staff to be successful, suggesting that some, if not all, of the technical issues may have been remedied. The trend, therefore, in the modernization of the Russian Armed Forces is toward greater information, network-enabled integration, placing more emphasis on speed of command and control, speed of operations, strategic and tactical mobility and networked-communications during combat operations. Moreover, an integrated communications model is now gradually becoming a reality in the Russian military, with all fixed command posts already digitized and plans to totally digitize the mobile command posts over the next several years. By late 2016, the signals command referred to the overall system as containing thirteen subsystems, and called for further sustained work to improve the functionality of the automated system.[67] These advances facilitate the functioning of the overall military decision-making architecture outlined in part one of this report.

3.3 Challenges and Vulnerabilities

While the Defense Ministry and defense industry struggled with the numerous issues involved in developing and introducing automated command and control systems for the Armed Forces, the complex nature of such a system functioning in the information space has also presented many additional problems and challenges. In professional Russian military publications, two themes that stand out are the problems of interoperability and information conflict (*informatsionnoye protivoborstvo*). These issues are frequently represented as being closely interconnected with Russia's military adopting and pursuing network-centric warfare capability, as noted in part one of this report. If there were conflict between militaries with network-centric capabilities then it would also involve the information space. But the interoperability issue is also one that weighs heavily in Russian military thinking and planning. This issue was addressed in detail in a 2017 article by A. Ya. Oleynikov and I. I. Chusov in *Vestnik*, the official publication of the Academy of Military Sciences (*Akademii Voyennykh Nauk*). The authors highlighted the fact that while NATO standards on interoperability are encapsulated in one document, in Russia no such document exists. They then turned to explore interoperability challenges in the context of the information era and the Russian military's adoption of network-centric approaches to warfare. Oleynikov and Chusov asserted: "At the same time — again,

66 Ramm 2016.

67 Galgash Interview, *Op. Cit.*

judging from open sources — work is not being done for now on a similar document in the Russian Armed Forces. If this is so, the conclusion can be drawn that under conditions of network-centric warfare the Russian Armed Forces will be unable to oppose a potential enemy and loss of command and control is possible, which means a threat to defense capability and in the final account to national security. Interoperability is also important in peacetime to ensure information interaction of Russian Defense Ministry structures with state authorities and with industry."[68]

The authors also note the absence of attempts to address the problem of standardization for creating a unified information space, which clearly has implications for Russian military decision-making. The importance of standardization for the information space is contained in the latest iteration of Russia's Military Doctrine (2014), the Concept of Forming and Developing a Unified Information Space of Russia and Corresponding State Information Resources, RF Military Doctrine (approved by Russian Federation President V.V. Putin on 26 December 2014), and the Information Security Doctrine (2016). However, these security documents do not address how to resolve the complex issues involved in standardization, while elsewhere the measures needed are outlined. For example, the Russian Federation State Program Information Society (2011-2020) (April 2014) provides a list of measures to include: "formation of open standards of interaction of information systems, including the development and support of an open standards profile of architecture of state information systems, formats, and data exchange protocols ensuring compatibility of state information systems and their components."[69]

Oleynikov and Chusov draw the conclusion that "high-level Russian conceptual documents such as the aforementioned ones give attention to questions of interoperability based on the use of Information Computers and Technology (ICT) standards, but we will note that this is a declarative level. At the same time, it is well-known that the level of work on ICT standardization in the Russian Federation is significantly lower than it is abroad."[70] In this sense, it seems the standardization issue and problems of interoperability impact on military decision-making, in addition to the complex challenges of unifying and fitting together multiple automated C2 systems.[71] It is therefore important to place Russian military decision-making in the context of the information space architecture and the Russian conceptualization of interoperability. Oleynikov and Chusov outline this as follows:

> The Concept of Interoperability in the Russian Federation Armed Forces follows directly from the Military Doctrine (2014), from the provision that combat operations must be conducted based on the network-centric warfare

68 Oleynikov/Chusov 2017: 61–68.

69 Ibid.

70 Ibid.

71 Kupriyanov 2010: 62–70.

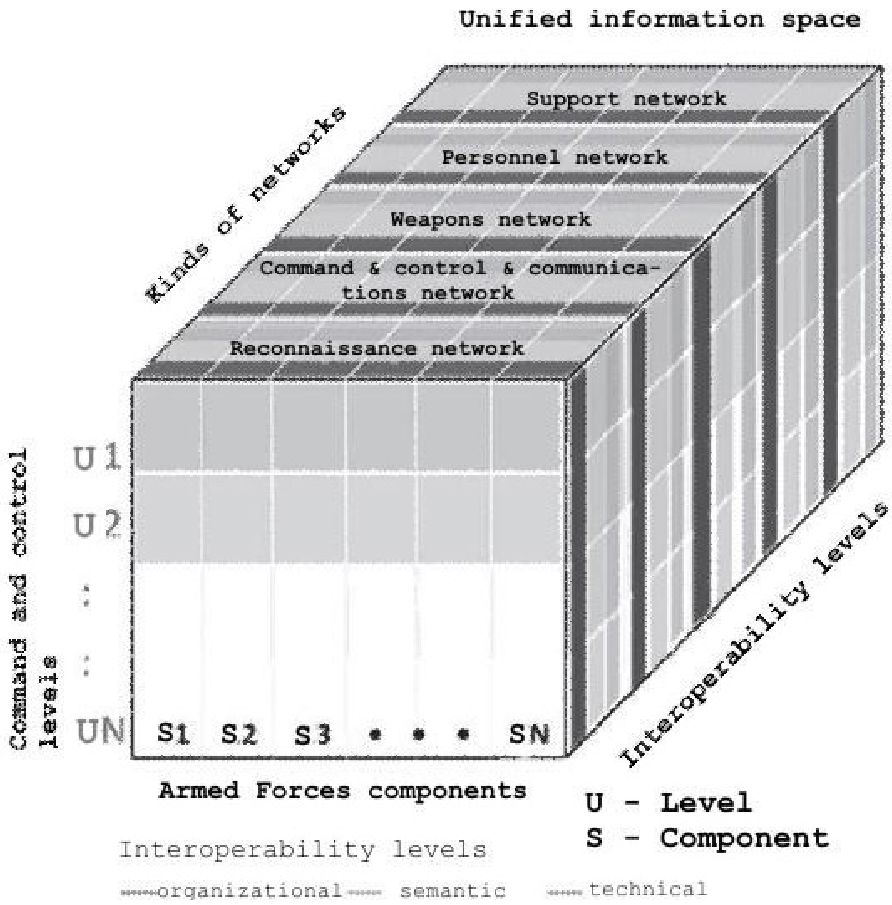

Fig. 4: Russian Three-Dimensional View of the Information Space (Oleynikov/Chusov 2017).

> concept. The network-centric warfare concept envisages an increase in the combat power of a grouping of joint forces through the formation of a unified information space that joins together information (reconnaissance) sources, command and control entities, means of destruction (suppression), and the real-time communication of valid and complete information about the situation to all participants of operations. The concept proposes the conversion of advantages inherent to individual ICTs into a competitive advantage through unification in a stable network of informationally sufficient, well-supported, geographically distributed forces. The RF Armed Forces' unified information space must encompass all functional components (reconnaissance, command, weapons), all levels of command and control, and all branches and combat arms. It is common knowledge that command and control levels include the strategic level, operational level, and tactical level.[72]

The Russian military views the information space as an architecture with three dimensions (see fig. 4). The constituent parts of the Armed Forces (combat arms and branches of service) are shown along the horizontal axis, the levels of C2 (strategic to tactical) along the vertical axis. The performance profile

72 Oleynikov/Chusov 2017.

(*funktsionalnyy razrez*) is displayed on the third axis: reconnaissance network, command and control and communications network, weapon engagement network, as well as personnel network and support network. According to the network-centric warfare concept, each part (cell or node) in this information space must have the property of interoperability in relation to any other cell or node within this information space.[73]

Thus, Russian military decision-making takes place within the context of the network-centric warfare concept and planning and conducting operations in the information space. The Russian Armed Forces' unified information space represents a supercomplex system (system of systems) which necessarily includes a large number of subsystems.[74] This suggests it is challenging to get by with a single profile and that there must be a hierarchy within the overall taxonomy.

Oleynikov and Chusov stress that achieving technical interoperability is clearly necessary but insufficient alone to ensure effective interaction. For interoperability to be achieved more fully it must be done at higher levels and, crucially, it has to be systemic, which is enormously complex. As they note, "These include methods of decision-making theory, methods of integration of unstructured information, graph theory and so on that are reflected in numerous publications." Moreover, since interoperability is vital in the military decision-making process, it is also important to note that in a conflict between network-enabled militaries the two sides will target each other's information systems. As the authors highlighted, in an information conflict each side will target and try to disrupt the enemy's use of the information space and degrade interoperability: "It is rather obvious that objects ensuring interoperability, the so-called 'key interfaces,' should be the targets of cyberattacks, and accordingly reliable protection must be provided for these objects where possible. This means that the makeup of the interoperability profile must include standards of protection and information security."[75]

3.4 Summary of Findings

Russia's MDMP fits into a wider military cultural and distinctive context, shaped and heavily influenced by the reform and modernization of the Armed Forces conducted over the past decade. The transition of the Armed Forces into the information era, adopting network-centric warfare capability, continuing experiments with C2 and adjustments to force structure as well as lessons learned from these initiatives and indeed from operations and exercises, has resulted in a complex system. This wider system, which involves the command struc-

73 Bystrov et al.: 31–38; Palagin/Krivoy/Petrenko 2009: 42–57.

74 Bystrov/Kozichev/Tarasov 2016: 162–170; Shcherbin 2015: 26–29.

75 Oleynikov/Chusov 2017.

tures and the order of battle, the automated C2 and the adoption of C4ISR, continues to lay great stress on the competence of individual commanders.[76]

The Russian MDMP seems less formalized than the one which is familiar to its Western counterparts. From a US/NATO perspective, Russian commanders in many cases will wait until they are confident that all information is gathered, and only then commence the MDMP.[77] While the presence of automated C2 systems and subsystems is designed to speed up the decision-making process, there are clearly challenges both with the integration of those automated systems and in terms of the end user. Equally, there are also areas where the decision-making process naturally slows, mainly at the strategic level, but the commanders in the field would face deep challenges if executing their MDMP in an information-challenged operational environment.

The adoption of network-centric approaches to modern warfare certainly has profound implications for the Russian Armed Forces, especially in the area of the MDMP. In fact, it inadvertently increases the need for more highly trained and competent commanders in the field with an ability to make decisions quickly and to delegate authority and responsibility; a challenge that is unfamiliar within the Russian military system. But part of the transition to C4ISR capability has been the overall structural changes in the C2 throughout the Armed Forces, which has a direct bearing upon the speed and efficacy of the MDMP.[78] Critical in the coordination of the process in the future will be the extent to which the NTsUO can be exploited as a mechanism through which traditional stovepiping may gradually erode, resulting in greater speed and coordination in setting the framework for the MDMP in real time during combat operations.

Strategic, operational and tactical levels of military operations are viewed differently within the culture of Russia's defense planning community compared to their US or NATO counterparts. And, the MDMP probably functions differently in the Russian system according the scale and mission of each type of combat operation.[79] However, the Russian MDMP seems less formalized and shorter than in NATO militaries and appears to offer less scope for flexibility.[80] In the authors' opinion, probably the most striking difference between NATO and Russian methodologies is that the Russian commanders, especially at the lower end of the tactical spectrum, have little or no concept of 'commander's intent.' The higher-level commander explicitly states the conditions of success for the completion of a combat order to subordinate commanders. This is fundamentally different from the NATO concept of *Auftragstaktik* or mission com-

76 Savin 2011; Sheremet 2005.

77 Major Donald R. Baker, U.S. Army: Baker 2003: 47.

78 Gorbachev 2015; Kotiv et al. 2016; Sharikov 2015; Litvinenko 2015; Babich 2015.

79 Kovalev/Larina/Sergeev 2014; Kruglov 1998: 54–58; Turko/Modestov 1996: 366; Kruglov/Lovtsov n.d.; Ionov 1994; Riabchuk 2001: 32–36; Interview with Retired Major-General Vladimir Dvorkin, the former head of the RF MoD 4th Central Scientific Research Institute (1993-2001): Svobodnaya Pressa, June 5, 2014; Kokoshin 2011.

80 Baker 2003: 46.

mand, which is not a system of command and control, but more of a philosophy that explicitly encourages subordinate leaders to take initiative within the commander's intent when the situation has changed and/or communications are denied.

There are, nevertheless, a number of challenges facing Russian military planners in seeking to boost the speed of the MDMP during combat operations. These relate primarily to the issue of integrating the existing automated ASU systems, further developing the capacity of the NTsUO, as well as completing in future the fuller equipping of the military with the ASU from strategic down to tactical levels. At present, it is clear that only part of the overall force structure has access to and is equipped with the capabilities associated with the ASU technology.[81] The equipping of the Armed Forces with the ASU has been subject to multiple delays, as well as the crisis in its development in 2012. Nonetheless, work in this area is evidently making progress, but it will be sometime before all these issues are addressed and fuller procurement occurs for the Armed Forces.

While the Russian Armed Forces have made marked progress in transitioning into the information era and adopting network-enabled capabilities, they will still face the challenge in future, if conflict erupts with another network-enabled military, of how to adequately manage their MDMP in an information-challenged operational environment. It appears, for the time being, that this issue is missing from Russia's operational-strategic exercises. This may give rise to revising training for officers and attempting to forge a new generation of commanders both at the levels of OSK and in the field.

4 A Comparative Analysis of US and Russian MDMP

4.1 Commander and Staff Roles

The US Army uses a commander-driven Military Decision-Making Process (MDMP) where the staff uses direction and guidance from the commander to study the situation and develop courses of action for the commander's review and approval. The Russian system is different. Although both systems are "commander-driven," the role of the commander in these systems differs substantially. The Russian commander is much more involved with the orders process, he is expected to personally generate the courses of action as well as oversee execution. In the Russian system, the commander, not the staff, develops the course of action.[82]

Upon receipt of orders, the Russian commander makes his decision based on his orders and understanding of the operational environment, and passes his decision to his staff and subordinate commanders for implementation. His

81 Morenko/Tezikov 2015; Kuptsov 2011: 10–17; Pristupyuk/Somko 2007.

82 Although the US does employ a Rapid Decision-Making and Synchronization Process (RDSP) that does streamline US/NATO MDMP, the fundamental differences between the NATO and Russian systems are still readily apparent, as the RDSP still involves the staff, and not the commander, developing the course of action.

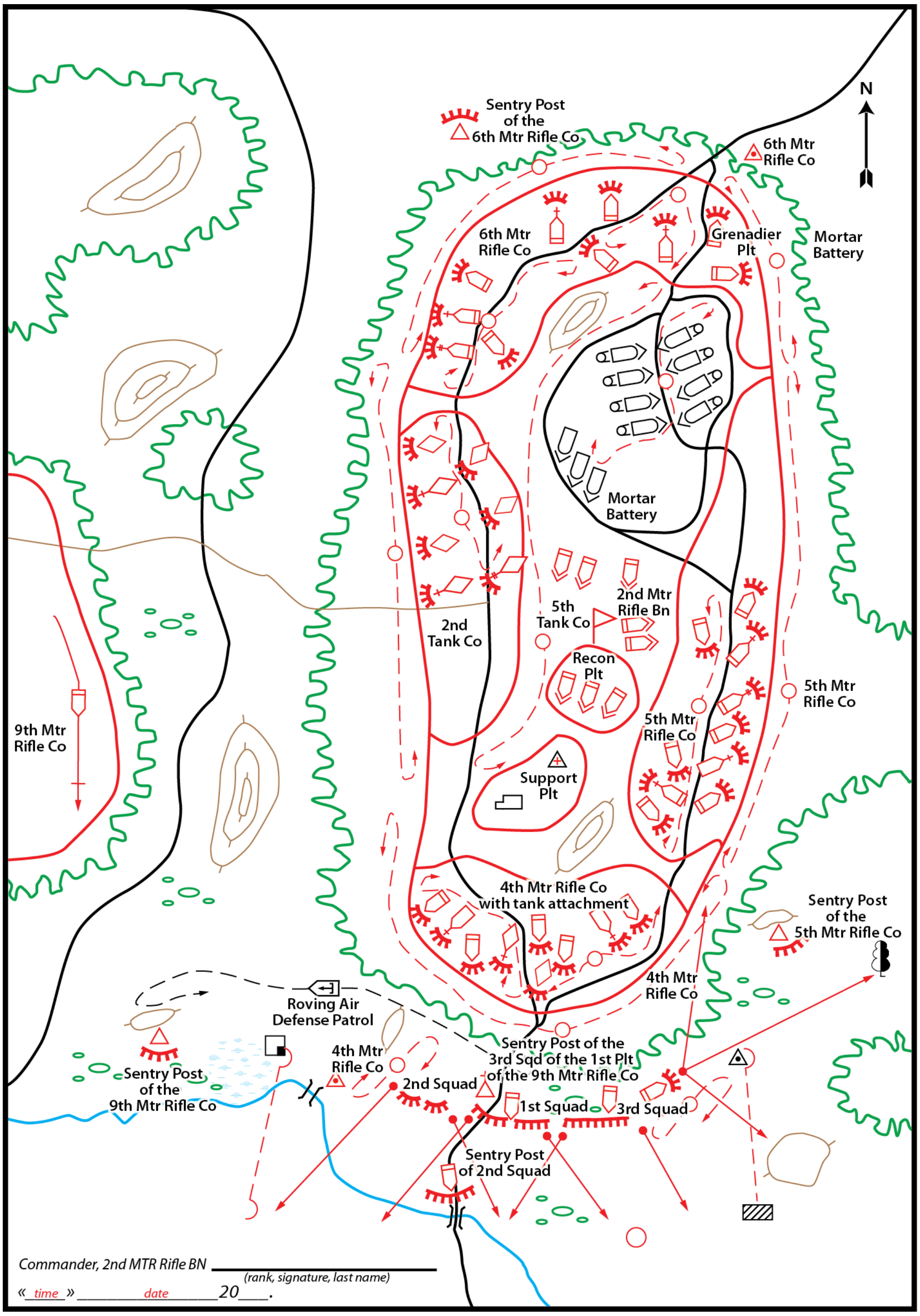

Fig. 5: Dispositions of a Motorized Rifle Battalion in a Staging Area (variant)

decision has at least three elements: the concept of the fight, tactical missions, and coordination. The concept of the fight specifies which enemy elements are to be destroyed by what resources and in what order; the sector of main effort; and the organization for combat and the concept of maneuver. The tactical missions are specified for the first and second echelons, reserves, artillery, air

Key Inputs	Steps	Key Outputs
• Higher headquarters' plan or order or a new mission anticipated by the commander	**Step 1: Receipt of Mission**	• Commander's initial guidance • Initial allocation of time
	Warning order	
• Commander's initial guidance • Higher headquarters' plan or order • Higher headquarters' knowledge and intelligence products • Knowledge products from other organizations • Army design methodology products	**Step 2: Mission Analysis**	• Problem statement • Mission statement • Initial commander's intent • Initial planning guidance • Initial CCIRs and EEFIs • Updated IPB and running estimates • Assumptions • Evaluation criteria for COAs
	Warning order	
• Mission statement • Initial commander's intent, planning guidance, CCIRs, and EEFIs • Updated IPB and running estimates • Assumptions • Evaluation criteria for COAs	**Step 3: Course of Action Development**	• COA statements and sketches - Tentative task organization - Broad concept of operations • Revised planning guidance • Updated assumptions
• Updated running estimates • Revised planning guidance • COA statements and sketches • Updated assumptions	**Step 4: COA Analysis (War Game)**	• Refined COAs • Potential decision points • War-game results • Initial assessment measures • Updated assumptions
• Updated running estimates • Refined COAs • Evaluation criteria • War-game results • Updated assumptions	**Step 5: COA Comparison**	• Evaluated COAs • Recommended COAs • Updated running estimates • Updated assumptions
• Updated running estimates • Evaluated COAs • Recommended COA • Updated assumptions	**Step 6: COA Approval**	• Commander-selected COA and any modifications • Refined commander's intent, CCIRs, and EEFIs • Updated assumptions
	Warning order	
• Commander-selected COA with any modifications • Refined commander's intent, CCIRs, and EEFIs • Updated assumptions	**Step 7: Orders Production, Dissemination, and Transition**	• Approved operation plan or order • Subordinates understand the plan or order

CCIR	commander's critical information requirement	EEFI	essential element of friendly information
COA	course of action	IPB	intelligence preparation of the battlefield

Fig. 6: Steps of the US Army's Military Decision-Making Process (Army Field Manual 6-0, Commander and Staff Organization and Operations, 17 May 2014, https://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/ARN14843_FM_6-0_Incl_C2_FINAL_WEB.pdf, last accessed on 01 February 2020.

defense and other subunits. Coordination includes objectives, phase lines, targets and times of link-up and achievement.[83]

The commander often outlines his plan on a battle map, selecting from a collection of well-rehearsed tactical battle drills. Following the commander's decision, he and his senior commanders make an on-ground reconnaissance of the area that they intend to fight on. Since the role of the commander is different in the Russian system, so is the structure and role of the staff at tactical levels. The Russian tactical staff is normally smaller than that of Western counterparts; this is due not only to the more active role of the commander, but also due to the emphasis on battle drills and repetition, which lessens planning duties. In addition, the staff makes extensive use of nomograms to support most aspects of staff planning, especially in the areas of logistics, artillery planning, and determining the correlation of forces. These nomograms are produced at higher levels (possibly at the General Staff, or one of its subordinate organiza-

83 Grau/Bartles 2017: 51.

Key Inputs	Steps	Key Outputs
• Receipt of mission (senior commander's decision) • Intelligence reports • Order allocating additional attached/supporting units	**Step 1: Commander's Plan**	• Commander's plan
• Coordinating instructions - attached/supporting artillery - engineer support - logistics	**Step 2: Commander's Terrain Reconnaissance** (with key subordinates) Simultaneous	• Staff issues warning orders • Updated running estimates
• Correlation of Forces and Means (COFM) analysis from higher headquarters (if provided) • Running estimates • Coordinating instructions - attached/supporting artillery - engineer support - logistics	**Step 3: Staff Verification**	• Correlation of Forces and Means (COFM) analysis • Mathematical verification • Back-brief to commander of plan viability • Route and area designations
• Correlation of Forces and Means (COFM) analysis • Running estimates	**Step 4: Issue Final Plan**	• Final plan in the form of a map - possibly with a 2-3 page written annex - signature of the commander - signature of the chief of staff • Subordinate commanders' receipt of mission • Updated running estimates
• Higher-level contingency options • Running estimates	**Step 5: Preparation for Combat**	• Contingency mission consideration/coordination

Fig. 7: Approximation of the Russian Military Decision-Making Process

tions) and are presumably updated as needed so they may be used to develop the staff's running estimates.[84]

Another significant difference between the staff systems are the duties of the staff members. In the Russian system, tactical staff members often command the troops associated with their staff section. For instance, if the Russian system were implemented in a US maneuver brigade, the brigade S-2 would also be the military intelligence company commander. Russian tactical staffs spend less time planning than their Western counterparts, but are more involved with the implementation of the commander's orders, by directly tasking their subordinates. This differs substantially from the US system, where the members of the brigade staff typically directly control few personnel. After the commander issues his initial orders, the staff and subordinate commanders begin their planning. The staff issues necessary warning orders while checking force ratios, requesting additional supplies, and adjusting frontages or dispositions to attain a mathematical probability of success. In Russian parlance, this is referred to as Correlation of Forces and Means (COFM) analysis and mathematical verification. Fragmentary orders assist and adjust the parallel planning. At the battalion level and above, the chief of staff produces the final battle map, which is the combat order and is signed by both the commander and chief of staff. There may be a small written annex of two to three pages. Within the US system, a strong staff can compensate for the weaknesses of a commander by submitting several COAs for approval, each of which would result in sufficient mission accomplishment. This is not the case with the Russian system, where the commander is not just guiding and deciding, but also doing the planning.

84 Grau/Bartles 2017: 51.

There is a Russian proverb that puts it in a nutshell: "As goes the commander, so goes the unit."[85]

Perhaps the easiest way of understanding the difference between US/NATO and Russian Military Decision-Making Processes is to imagine the concept in the terms of American football. If the US/NATO MDMP were applied to a football team, after each play the head football coach would provide his coaching staff with a general intent on how to move the ball forward. The football coaching staff would take this intent and develop a few ideas to pitch the head coach. The head coach would then select the best idea, and the staff would draft a plan for the execution of the idea, which the coach would later approve, and then issue to the team. If the Russian MDMP were applied to a football team, the team would arrive at the game with a playbook with some well-rehearsed plays. Although the team would not be very effective if they had to execute an unprepared play, they are very effective when executing prepared plays. Since the plays are frequently rehearsed, they can be executed with little or no preparation. The coach/quarterback may call the play from the line of scrimmage, making minor adjustments as needed. Those familiar with American football will understand that the Russian MDMP process has much more in common with the way American football is played than the US MDMP process.[86] But it does beg one question: What is the 'Russian playbook'? The answer is that Russian tactics are located in the "Combat Regulations of the Ground Forces" (*Boyevoy ustav sukhoputnykh voysk*), a series of manuals updated every few years (other branches of service and ministries with military forces have different regulations, but the principle remains the same). In practice, the Russian system of decision-making requires a somewhat rigid system of tactics. Russian tactics at battalion level and below can best be described as battle drills that are standardized for Ground Forces, Naval Infantry, and Airborne (VDV) units.

In an academic environment, officers study the various tactics found in the combat regulations, their historical employment and how they should be adjusted for operational variables. This manner of conducting tactical maneuver may explain why Western militaries and intelligence services studied Soviet tactics by way of doctrinal templates (DOCTEMPs), the way that Soviet tactics were described in combat regulations, and situational templates (SITTEMPs), the way these templates were adjusted during implementation to account for operational variables, such as terrain, enemy capabilities, weather, etc. The most important take-away from this understanding of the Russian military decision-making process is that one must be familiar with the current combat regulations to be reasonably able to ascertain probable Russian tactics for a given situation.[87]

85 Grau/Bartles 2017: 54.

86 Bartles 2018: 1-9.

87 Bartles 2017: 10–17.

MINISTRY OF DEFENSE OF THE RUSSIAN FEDERATION

COMBAT REGULATIONS

FOR PREPARING AND CONDUCTING COMBINED ARMS BATTLE

PART III

PLATOON, SQUAD, TANK

Fig. 8: Combat Regulations.

4.2 Military Decision-Making in Relation to War Fighting Functions

Since the Russians use a military decision-making process that differs greatly from the one used in the West, applying the Western concept of War Fighting Functions (WFFs) to their tactics and operations should be done with great care. In practice, the Russians do not discuss or even have a concept of WFF (Movement and Maneuver, Fires, Intelligence, Sustainment, Mission Command, Protection) as distinct elements assigned to various members of the staff. Instead, the WFF are always discussed in aggregate. As the commander is much more involved with the mechanics of planning, he is also responsible for the coordination of the WFFs, which is essential for the execution of the mission. One example of how the Russian system is different from the US system is how the Russians handle Intelligence, Surveillance, and Reconnaissance (ISR). In the US system, ISR falls squarely in the Intelligence WFF, with the intelligence staff bargaining and compromising with the other WFFs for resources and priorities, such as UAVs, which the brigade's intelligence staff typically do not directly control.[88]

In the Russian system, the commander is responsible for intelligence, along with the other WFFs, and he decides what does and does not get resourced. All assets that are capable of performing ISR functions, such as the UAV company's UAVs, the air defense battalions' radars, the electronic warfare company's sensors, and the brigade's reconnaissance battalion and signal intelligence platoon are used as he deems fit, and are networked accordingly. The commander

88 Grau/Bartles 2017: 55–56.

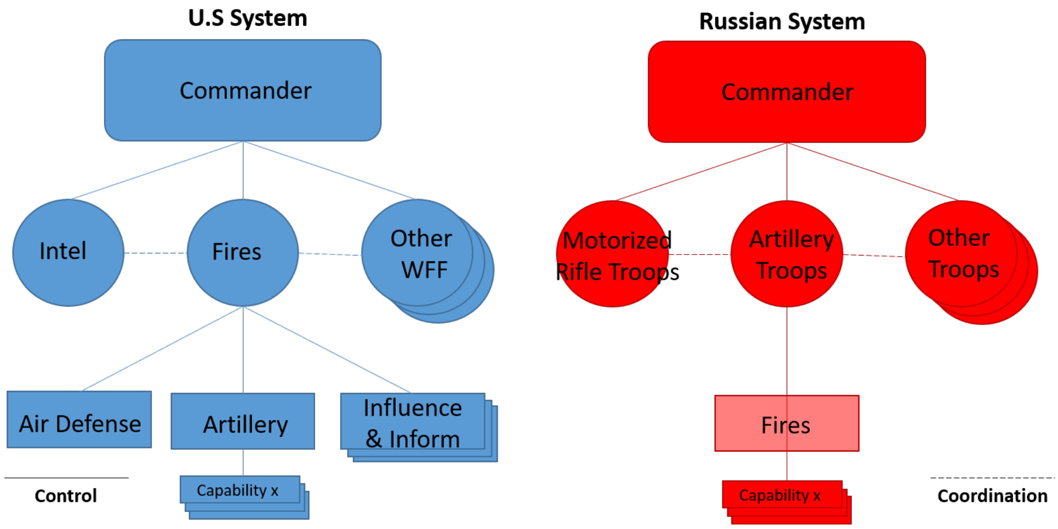

Fig. 9: War Fighting Functions Comparison (Fires).

will pull assets as needed to perform other tasks associated with other WFFs, but this is done at his discretion, never as a compromise among the staff. This system prevents any problems that could arise from a particularly dominant personality on the staff acquiring more resources than would otherwise be allocated. The commander's personal attention to all of these aspects seems daunting to most persons familiar with the Western MDMP, but not unduly so for Russians. Since a Russian commander usually just selects maneuvers from his well-rehearsed tactical battle drills, the details of WFFs only need to be tweaked as necessary to fit the operational environment.[89]

4.3 Comparison and Insights

Although both US and Russian MDMP systems may be a similar step-by-step process, there obviously are critical differences. According to US and Western officers that have interacted with their Russian counterparts during peace support operations in the Balkans, there seem to be four main distinctions in the Russian approach to MDMP. (Admittedly, there may also be differences in how Russians approach the MDMP depending on the mission type.[90]) First, they appear to use a shortened, but largely informal MDMP. They intentionally wait until the very last moment possible before making a decision. Russian commanders wait until they are confident they have gathered as much information as needed before they commence the MDMP. Within the Russian system, the personality of individual commanders plays a major role in the MDMP. And, finally, the Russian system, as noted, is designed to support a highly capable commander and a smaller staff. This raises questions concerning the effectiveness of the MDMP if the commander on the ground lacks such competence.

89 Grau/Bartles 2017: 56.
90 Baker 2003: 46–50.

Some aspects of these differences are worth highlighting. The military cultures and systems in the US, NATO or Russian militaries reflect the individual and distinctive approaches to standards and methods designed to fit. In the US or allied NATO militaries, individual initiative and problem solving, as well as delegated authority, play a much more prominent role especially at the tactical levels of the process. Therefore, as the information flow starts, a US or NATO commander will also begin the MDMP with his or her staff. However, their Russian counterpart at this stage will not do so. The Russian commander, as observed, begins the MDMP only once the information is assembled.[91] In the Russian military system, the initiative and problem-solving skills are located higher up in the system, consequently with less need for this at tactical levels. In some circumstances, especially in a future conflict between network-centric militaries where each side will target the information systems of the other, it is likely to impact on Russian commanders more than US or NATO counterparts. Hypothetically, some Russian commanders in these circumstances would not be trained to initiate the decision-making process in an operational environment where the information flow is disrupted. And those commanders willing or capable of commencing the decision-making in the absence of the necessary information would most likely perceive themselves to be engaging in decision-making in effect partially blinded.

4.4 Theory of Implementation

The Russian education system continues to emphasize mathematics and science. Consequently, "math anxiety" is not a problem, particularly among military professionals. Mathematical determination articles are a normal part of most Russian professional military journals, and Russian officers use mathematical models to aid in their planning. Nomograms and calculations quickly resolve issues such as determining pass times and march durations; duration and density of artillery fire to achieve the necessary percentages of kills and equipment destruction in area fire missions; the time and place where the forces will encounter the enemy main force; the optimal march routes; the time required to move from the assembly area and transition from battalion to platoon attack formation; the artillery expenditure required during this transition or the numbers of trucks and trips required to move tonnages of different cargo.[92]

The math does not stop there. A key component of operational and tactical planning is determining the Correlation of Forces and Means (COFM). This

91 Author discussions with US military officers and defense officials Washington, DC, November, 2018.

92 A nomogram is a diagram representing the relations between three or more variable quantities by means of a number of scales so arranged that the value of one variable can be found by a simple geometric construction, for example, by drawing a straight line intersecting the other scales at the appropriate values. For examples, see Vayner 1982. The formulae and nomograms in this book have since been computerized, updated and expanded to further speed up planning.

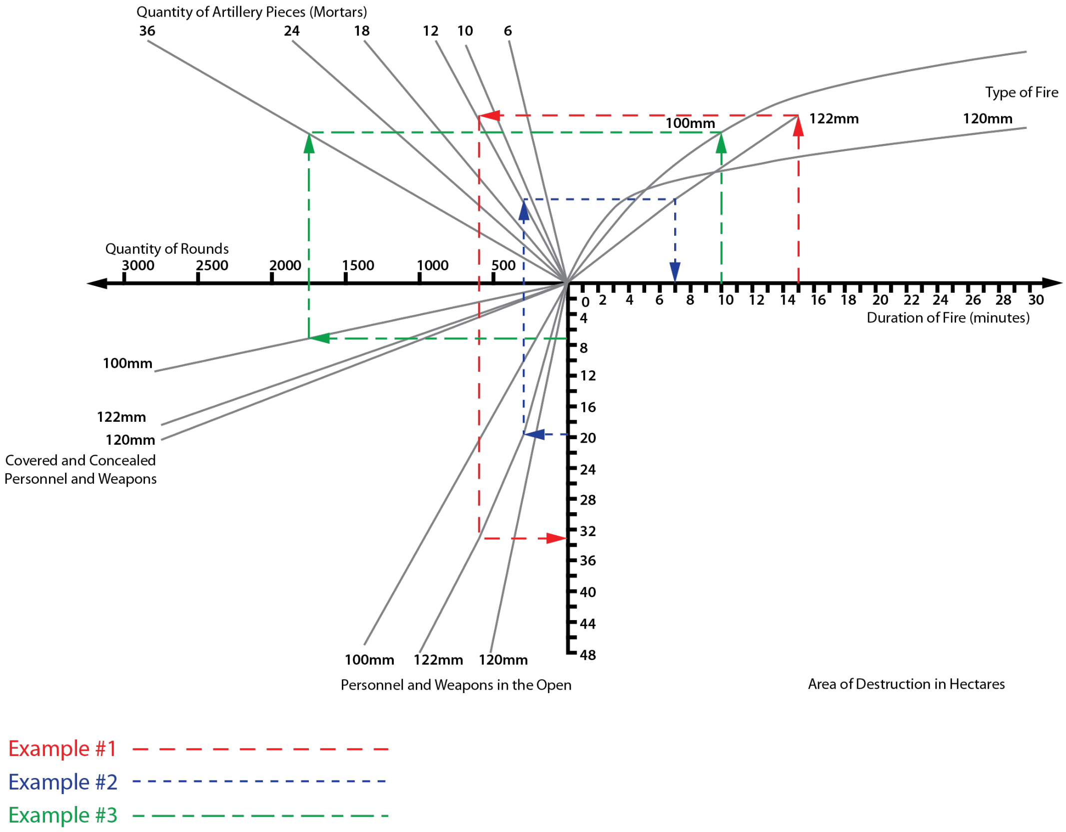

Fig. 10: Nomogram Example.

$$S_i = \frac{N_i \bullet n_i(t)}{m_i}$$

S_i the target area in hectares (2.471 acres)

N_i the quantity of assigned artillery pieces (mortars) of *i* caliber

$n_i(t)$ the sustained rate of fire of one artillery piece (mortar) of *i* caliber expressed in rounds per minute

m_i the quantity of rounds required for the destruction of one hectare of the target area expressed in rounds per hectare.

Fig. 11: Nomogram Example (legend)

methodology is the mathematical determination of the combat power of the opposing sides after making mathematical adjustments for differences in combat systems, quantity and quality of systems, quality and training of the forces, terrain, morale, activity (attacking, defending, withdrawing, flanking, etc.), and combat experience. The COFM provides the ability to determine a mathematical probability of success, the most advantageous avenues of attack or withdrawal and the rate of advance in an operation or battle, and can be the decisive determinant in the commander's decision.[93] Determination of the Correlation of Forces and Means used to be a fairly lengthy mathematical drill, but the meth-

93 Ministry of Defense of the Russian Federation, "Sootnosheniye sil i sredstv [Correlation of Forces and Means]", *Military Encyclopedia*, Volume 7, Moscow, Voyenizdat, 2003, 583-584.

odology has been computerized and upgraded. Mathematical models are also widely used for ammunition, fuel and personnel expenditure rates.[94]

4.5 Implementation of the Planning Process

Computerization, automation and streamlined staff procedures are a priority for Russian staff planners. The motorized rifle brigade has five personnel in its operations section (two officers, two sergeants and one civilian). According to a recent Russian estimate, "typical" brigade-level staff procedures take up 200 man-hours per week. Experience shows that this translates to the requirement to produce 1.5-2 pages of printed text or enter 600-800 tactical symbols and operations notes per hour. Fatigue impacts on this output. For a "typical" brigade battle plan, the operations section spends three hours alone on planning rear services (supply and maintenance) support. Previously, this planning could take up to a day. The Russian goal is not simply to make the planning process faster; the Russian goal is to make the planning process faster than that of the potential adversaries. Current Russian estimates suppose that the most advanced foreign armies require eight hours to produce a battle plan; the Russian goal is to reduce their planning process for a similar Russian force to under six hours. In US military speak, the Russians are attempting to gain a decisive mission command advantage by using a shorter OODA (Observe, Orient, Decide, Act) loop vis-à-vis their adversaries.[95]

4.6 Relation of Russian MDMP to Automated Command and Control Systems

Perhaps the greatest factor that has caused the development of such a different planning process is Russian thinking on future war. The Russian Armed Forces still believe their first priority is high-speed maneuver warfare, and they believe their system is ideally suited for this purpose. (The Russian Ground Forces do not see a need to implement a planning system that more easily facilitates counterinsurgency or nation building.) Although the study of battles in World War II is rare in the West, these battles are still widely studied in the Russian military at all levels. The Soviet experience in World War II has taught generations of Russian officers that high-intensity maneuver warfare is extremely fluid. The best-laid plans are quickly overcome by events as the situation rapidly develops. The best way of military decision-making (in the Russian view) is not an in-depth staff planning process that requires much coordination and de-confliction. The best way is a system where one person (the commander), who has situational understanding, rapidly issues timely orders to perform

94 Grau/Bartles 2017: 56.

95 John R. Boyd, PowerPoint presentation "The Essence of Winning and Losing," January 1996, updated by Chet Richards, Chuck Spinney, and Ginger Richards in 2012. https://fasttransients.files.wordpress.com/2010/03/essence_of_winning_losing.pdf, last accessed on 01 February 2020. Grau/Bartles 2017: 57.

standard tactics and/or battle drills (as appropriate) adjusted for the enemy, terrain, etc. (operational environment) to influence the outcome of the battle. While the US and the West have made great efforts to incorporate technological developments into modern warfare, there has been relatively little effort to refine the NATO military decision-making process. This is not the case for the Russians. They believe that an Automated Command and Control System (SU) is a key development for Russia attaining information dominance on the modern battlefield by allowing a Russian commander to more quickly gain situational understanding, draft and transmit plans, and execute operations more quickly than his adversary (shorter OODA loop). The desired Russian end state is to field a decision-making system that cycles faster than the adversary's decision-making system.[96] Although ASUs may be fielded (in some form or another) by the US and NATO, these systems will likely have relatively less impact. This is due to the fact that some of the automated command and control systems' advantages may be diminished because the US/NATO military decision-making process requires more human inputs, such as human produced staff estimates, as opposed to the Russian system which depends more on algorithm-based estimates.

5 Implementation of Automated Command and Control Systems in the Russian Ground Forces

5.1 Specific Automated Command and Control Systems in the Russian Ground Forces

In regard to the specific ASUs employed in the ground combat elements of the Armed Forces, namely the Ground Forces, Naval Infantry, and Airborne (VDV), there are two main systems found at the division/brigade level down to the individual squad. The Andromeda-D, one of the first such modern ASUs fielded, was first introduced in the VDV, and was likely a model for the Ground Forces' Integrated Tactical Echelon Command and Control System (YeSU-TZ) (*yedinaya sistema upravleniya takticheskogo zvenacommunication*). The *Akatsiya-M* ASU is a relatively new system that is being fielded in Russia's operational-level Ground Forces' commands (12 Combined Arms Armies and 4 Army Corps). The system will not only provide C2 and situational awareness for the operational commander regarding his own directly subordinate units, but will also allow for liaising with, or command and control of, attached units of the Navy, Aerospace Forces, and Airborne Troops. In addition, the *Akatsiya-M* will be integrated with the Russian National Defense Management Center.[97]

96 Blog site of Lieutenant General Sergei Skokov, former Chief of Staff of the Russian Ground Forces, "Otsenka obstanovki v voyennom dele - chast' vtoraya" [Assessment of the Situation in the Military - Part Two], http://general-skokov.livejournal.com/2691.html, last accessed on 01 February 2020.

97 Ramm/Kruglov 2018.

All of these ASUs are intended for troop command and control during the conduct of combat, peacekeeping, and humanitarian operations, as well as while in garrison. They are designed for the continuous exchange of data among command posts, headquarters, and troops. Reconnaissance systems, including unmanned aerial vehicles and satellites, have reportedly been integrated with the automated command and control systems. This permits the collection of information about the enemy in near real time. ASUs also consolidate the data about losses, equipment readiness, the availability of ammunition and petroleum products and lubricants, and even about the morale-psychological state of the personnel, as commanders and personnel in subordinate units input information into the system that is, in turn, aggregated and relayed to higher headquarters. Russian ASUs create maps, on which the disposition of the troops and weapon systems is depicted, in a manner very similar to the US "Force XXI Battle Command Brigade and Below" (FBCB2) system, which was begrudgingly well regarded by many Russian sources when first fielded. The intent of this near-real-time depiction of friendly and enemy forces is to facilitate commanders' situational awareness so threats may be responded to in a timely manner. Perhaps the most interesting advantage of the ASU is how it could speed up the Russian MDMP, a topic that will be explored later. The terminals for tactical ASUs vary based upon the echelon they service, but most depictions show tablets at the platoon/squad level, and laptops at company-level and higher, that are typically mounted in command and control vehicles.[98] It is important to note that these systems are distinct from the Reconnaissance Fire System (ROS), such as Strelets and *Barnaul-T.*[99] These systems reportedly communicate with each other, but the level of integration has not been publicly disclosed.

5.2 The Russian Military Decision-Making Process in Summary

Russia's Armed Forces have undergone considerable transformation since their reform was initiated in 2008. A central component in this process has been to improve the speed and efficiency of C2 both by streamlining the structures in-

98 Ramm 2016.

99 *Strelets* is a network-centric C4ISR system that successfully integrates operators, reconnaissance assets, command elements, and very different fires systems to include ground-based tube artillery and rocket artillery; ballistic and cruise missile; strike aviation; and ship and coastal naval fires. It can reportedly task fires rapidly at all levels of battle, from front line artillery to deep strike aviation, through rear area missile strikes, at the tactical and operational depths. *Barnaul-T* is a network-centric C4ISR system that is employed at battalion/battery level for air defense. Strelets and Barnaul-T and other such systems are sometimes referred to as components of the Integrated Tactical Echelon Command and Control System (YeSU-TZ), and other times referred to as Automated Command and Control Systems (ASUs) in their own right. Occasionally, the term "Automated Command and Control System of Troops (ASUV)" [Автоматизированная система управления войсками (силами), (АСУВ)] is used instead of the term "Automated Command and Control System (ACS) [автоматизированная система управления (АСУ)]". Apparently, this less frequently used term emphasizes that the system is an all-encompassing mechanism for controlling troops, and not specifically a C4ISR system for fire direction.

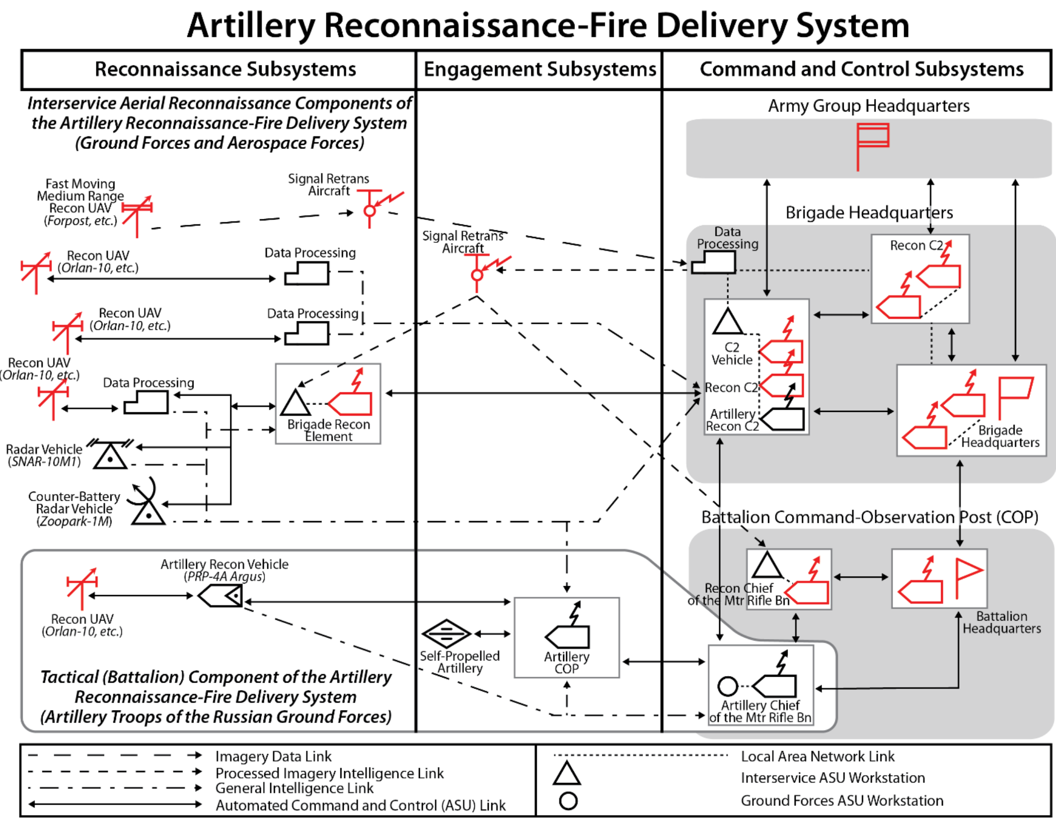

Fig. 12: Visualization of Automated Command and Control System Links.

volved and by adopting new technologies, critically important in this regard being the ongoing efforts to enhance automated C2. These complex processes have impacted on the Russian military approach to the MDMP. In terms of structures, the strategic, operational and tactical levels are increasingly integrated by the NTsUO and the wider adoption of C4ISR. As noted, the Russian approach to MDMP is more suited to large-scale warfare, with its primary focus centering on high-speed decision-making in the context of maneuver warfare. The authors have sought to highlight some of the key differences in the Russian perception and use of their version of the MDMP, noting that it is not a question of whether one system is 'better' but simply that they have a different and unique approach to the MDMP.

The Russian tactical military decision-making process not only starts with the commander, but is also executed by him as well. This process is facilitated by well-rehearsed battle drills, permanent combined arms subunits, quick and effective staff procedures and improved planning tools. It is a different approach than that of Western armies and does not use their more staff-driven, war-fighting-functions methodology for military decision-making. The Russian MDMP system is inherently more rigid than its Western counterpart, but this rigidity is not necessarily a weakness, as it provides the Russian MDMP system its greatest strength—speed. The US/NATO MDMP system is ideal for situations such as the Gulf War, when the operational tempo is controlled, making lengthy planning periods feasible; but the Soviet/Russian system was designed for high-speed maneuver warfare, with rapidly developing situations that provide little opportunity for lengthy planning. The Russian personnel system was built to support this system: Battle drills are emphasized for junior officers and their enlisted soldiers, while more senior officers focus on the study of tactics and their historical employment.

This system is not well suited to a staff-centric War Fighting Function (WFF) methodology as practiced by the US/NATO; instead, it is much more like a flow chart or computer algorithm, with the staff simply imputing variables. In the past, this planning process was conducted using nomograms to facilitate the staff planning process; but with the advent of modern computers, the Russian Armed Forces are now able to digitize and thereby rapidly expedite staff estimates through their Automated Command and Control Systems (ASUs). These ASUs use this information to wargame potential courses of action, provide options for improvement, and eventually disseminate orders, and they significantly enhance the greatest comparative advantage of Russian MDMP system vs. the US/NATO system—*speed*!

5.3 Implications for NATO

Leon Trotsky, the People's Commissar of Military and Naval Affairs in the Soviet Union from March 13, 1918 – January 6, 1925, once wrote: "Our class enemies are empiricists, that is, they operate from one case to the next, guided not by the analysis of historical development but by practical experience, routine, coup d'oeil and flair."[100] Although the communist ideology has long passed, this statement is arguably as applicable to the Russian and the Western militaries of today, as it was when written by Trotsky regarding the Soviet and the Western militaries almost one hundred years ago. Obviously, communist ideology is no longer a motivator of the Russian government and military; but its foundations of dialectical thinking are still readily apparent. And so, with Trotsky's statement, one can begin to understand the importance of understanding the Russian military decision-making process for NATO planning and training purposes at the tactical and operational/strategic levels, as there are many differences between the two approaches.

At the operational/strategic level, understanding the Russian military decision-making process is essential if NATO ever intends to transition from simply reacting to the Russians to proactively shaping their actions. But even before this problem can be approached, we must first be aware of, and understand, Russian threat perceptions and intent, since these are the factors that drive Russian actions. Inaccurately attributing terms such as "hybrid war," "Russian New Generation Warfare," and "Strategic Ambiguity," as Russian policy only detracts from our understanding, and hinders our ability to forecast and shape

100 Leon Trotsky, "Military Doctrine or Pseudo-Military Doctrinairism," Supreme Military Publishing Council, Moscow, 1921, as found in translation at Marxist.org https://www.marxists.org/archive/trotsky/1922/military/ch37.htm, last accessed on 01 February 2020.

future Russian actions. No NATO commander questions the value of understanding his or her own commander's intent; we suggest that it is just as important to understand the potential adversary's intent. Perhaps the most damaging consequence of the use of these terms is the difficulties they cause us in formulating our own problem statements. Instead of considering how to deter undesired Russian activities in its periphery, we are thinking about how to deter and combat imagined Russian theories and doctrines.

Aside from the possibility of shaping Russian actions at operational and strategic levels, studying the Russian system does provide some valuable insights, which could be incorporated into NATO planning. The Russian tendency to value historical research instead of the latest and greatest theory means that Russian operational and strategic planners are less susceptible to notional concepts such as "hybrid war," "Russian New Generation Warfare," "Gray Zone", and "Strategic Ambiguity." While NATO planners are studying these ideas, Russian planners are studying long-standing theorists such as Svechin, Tuchachevsky, Shaposhnikov, Triandafillov, Isserson, etc., as it is not uncommon for Russian planners to read these works (many published in the 1920s/1930s) in their entirety. The character of war may change, but not its nature.

In a similar vein, the dialectical slant of Russian military thinking makes the adoption of rigid theoretical paradigms unacceptable. The well-loved paradigms of Western planners such as METT-TC (Mission, Enemy, Terrain, Troops – Time, Civilian), PMESII-PT (Political, Military, Economic, Social, Infrastructure, Information, Physical Environment, and Time), DIME (Diplomatic, Informational, Military, and Economics), etc. have no Russian equivalents, as they are seen as constraining and perceived to channelize thought. As the prominent Russian theorist Alexander Svechin observed: "A particular strategic policy must be devised for every war, each war is a special case, which requires its own particular logic rather than any kind of stereotype or pattern no matter how splendid it may be."[101] Perhaps even more baffling, from a Russian perspective, is how the Western military decision-making process is simply "up-scaled" from the tactical to operational level, with little distinction between them. For example, in the Russian system, there is no "Joint Publication 3.0, Joint Operations" as published by the US Joint Chiefs of Staff that neatly lays out operational-level planning and that appears to be quite similar to the US Army's "Field Manual 3-0, Operations."[102] In the Russian system, the responsibility for operational-level planning resides exclusively in the General Staff. As previously described, the Russians have a somewhat algorithm-based tactical military decision-making process, but there is no similar structure at the operational level, as each conflict must be approached with its own particular logic. We suggest that, if there is an intent to understand the Russian military decision-making process

101 Svechin/Lee 2004: 62.

102 Joint Publication 3.0, Joint Operations, 12 January 2017 https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_0ch1.pdf?ver=2018-11-27-160457-910. Field Manual 3-0, Operations, October 2017, https://fas.org/irp/doddir/army/fm3-0.pdf, last accessed on 01 February 2020.

at the operational/strategic level, we must first abandon templating Russian actions in the terms of Western neologisms. Then it will be necessary to shift to a systemic study of Soviet operational art and of how this operational art would be applicable by the Russian Armed Forces in the current operational environment.

At the tactical level, to our knowledge, most training scenarios regarding Russia are based upon recent (empirical) studies of Russian Tactics, Techniques, and Procedures (TTPs) in the Crimean Peninsula, Eastern Ukraine, the Baltics, Syria, and along Russia's borders. It is true that Russia has tested new equipment and TTPs in these areas, and their employment should certainly be studied, as they facilitate our situational awareness. However, just because the Russians apply certain TTPs in one situation they will not necessarily do the same thing in another. While there has been much discussion in the West about the hybrid threat (criminal gangs, terrorists, insurgents, etc.), Battalion Tactical Groups (BTGs) and the Russian use of unmanned aerial vehicles, there has been little examination of how Russia executes combined arms brigade and division-level operations —echelons the Russian military believes are essential for conducting warfare with a technologically sophisticated adversary such as NATO.

As previously described, Russian command and control capabilities have significantly improved, so although NATO well understood the Soviet military, new efforts must be made to understand and train against the way a modernized Russian Army would fight. Complicating this effort is the shift that many NATO armies made from large-scale combat to counterinsurgency operations (COIN), which is now hampering their ability to conduct the former. For instance, during the Cold War, the US Army trained against an opposing force (OPFOR) modeled on the Soviet Army. Due to very different threat concerns in the post-Soviet era, the US Army abandoned a threat-based (Soviet) OPFOR in favor of a capability-based OPFOR that is a composite of threats and potential capabilities. Current US Army regulations prohibit US Army units from training against a Russian-based OPFOR.[103] As a result, most US soldiers have no concept of how an adversary employing a different decision-making process could fight. An additional challenge is finding individuals with the requisite knowledge to role-play Russian commanders for training and exercise purposes. While

103 "*Opposing forces*. An OPFOR is a plausible, flexible, and free-thinking mixture of regular forces, irregular forces, and/or criminal elements representing a composite of varying capabilities of actual worldwide forces and capabilities (doctrine, tactics, organization, and equipment). The OPFOR is used in lieu of a specific threat force for training and developing U.S. forces. The OPFOR is tailored to replicate highly capable conventional threats and unconventional threats that combined can replicate hybrid threats and their strategies further described in the Training Circulars (TCs) 7–100, 7–100.2, 7–100.3, hereafter referred to as TC 7–100 series of manuals, and Field Manual (FM) 7–100.4. … While other units and individuals can be tasked to portray OPFOR for use in training events, all OPFOR will operate using doctrine and organizational structures approved by the TRADOC DCS, G2 (herein referred as the TRADOC, G2)." (Army Regulation 350-2, Operational Environment and Opposing Force Program, 19 May 2015, https://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/r350_2.pdf, last accessed on 01 February 2020).

knowledge of Soviet tactics may have been common in NATO during the Cold War, the same cannot be said today. Although these role-players often have excellent experience commanding NATO units, few of these individuals even have a rudimentary knowledge of the Russian military decision-making process. In fact, most of these individuals have never heard of the "Combat Regulations of the Ground Forces" (Boyevoy ustav sukhoputnykh voysk), let alone are familiar with its contents. In short, until there is a firm understanding of the Russian military decision-making process, tactics and operations, and NATO personnel are accustomed to training against these, there is no way to prepare adequately for a potential adversary as dynamic and lethal as the Russian Armed Forces.

Unfortunately, emulating the Russian military decision-making process in tactical training is no guarantor of successful outcome in the event of a conflict with the Russian Federation. The Russian military decision-making process has comparative advantages and disadvantages vis-à-vis the NATO system, and its officers are just as innovative as those of NATO; but they will innovate within the context of the Russian system, as NATO officers and noncommissioned officers will innovate within their system. Victory for NATO in such a conflict is dependent upon a vast number of variables, but what can be said is that any engagement with the current level of tactical understanding of the Russian military decision-making process will certainly involve a steep learning curve, meaning a much higher cost in blood and materials. Although incorporating the Russian military decision-making process into training scenarios will not guarantee success in such a conflict, it will do much to help NATO commanders go a step beyond situational awareness— situational understanding. Therefore, we suggest that emulating the Russian military decision-making process in NATO training is just as important as studying the relevant Russian Tactics, Techniques, and Procedures, and understanding that Russia will not fight a peer as it fights a lesser opponent.

ANNEX A

MDMP and Automated Command and Control Systems: A Theory of Implementation

Although there has been much discussion in the Russian media about the introduction of ASUs into the Russian Armed Forces, there has been almost no mention of how these ASUs will be integrated. But one knowledgeable Russian military blogger may provide some fascinating insight. The following 2012 excerpted blog post by "dragon_first_ru" describes how the Russian MDMP could be turned into an algorithm to facilitate processing by an ASU. Although the author makes it clear he does not see the YeSU-TZ as being capable of functioning as a viable ASU in 2012, he does outline how such a system could work, and makes it clear that he believes an algorithm-based ASU is feasible.[104]

ASUV YeSU-TZ [Automated Command and Control Systems of Troops of the Integrated Tactical Echelon Command and Control System], Part 9, Conclusion

On Tuesday our Commander-in-Chief conducted the latest (it would be interesting to know how many there have been) meeting devoted to the problems of carrying out the state defense order in the area of arms purchases.

I quote *Rossiyskaya Gazeta*:

> The cancellation or delay in the execution of one contract can, in essence, bring down the entire plan, Putin noted. It is important to ensure the balanced and comprehensive development of weapons systems. According to the President, 'dozens if not hundreds of subcontractors' participate in the production of military equipment. For example, artillery cannot be delivered to the troops 'if the ammunition, or the optics, or the guidance, or the surveillance equipment is not ready'… The head of state was especially displeased with the disruptions in development and delivery of the new airborne combat vehicle to the troops, as well as with the creation of an integrated tactical command and control system (YeSU-TZ). Such systems are successfully used in a number of foreign militaries, facilitating the command and control of troops through satellite clusters, UAVs, and navigational equipment. In the opinion of the President, the Russian analog, which must use the domestic system GLONASS, does not meet the criteria that were assigned by the Ministry of Defense. Furthermore, the timeline for development of the ESU has been excessively pushed back – work has been ongoing for almost 10 years already.[105]

What exactly did not correspond at this time between the requirements of the military and the capabilities of the current version of the YeSU-TZ has been de-

104 The authors would like to extend a special thanks to Mr. Clint Reach at the RAND Corporation for the translation of this blog. For purposes of clarity, this translation has been slightly edited. Military blog by dragon_first_ru at: http://dragon-first-ru.livejournal.com/36850.html, last accessed on 01 February 2020.

105 A direct quote was used by the author in the blogpost. Galitsky 2012.

scribed in detail in earlier sections of this topic as well as in other posts that have been published on my blog under the tag "Automated Command and Control System of Troops (ASUV)".

Naturally, given my limited knowledge, I was not able to list absolutely all of the existing inadequacies of the current version of the system. Nevertheless, I suspect that you, respected readers, can imagine the primary problems of the ASUV that has been developed for the Ground Forces at the tactical level.

For an objective picture we must lay out the "global desires" of the customer of the system {Russian Ministry of Defense}, that is, accurately picture the level of expectations that have been placed by our military leadership on the tactical ASUV.

Therefore, in the summary portion of this blog topic I would like to focus on one, principle in my opinion, issue, which at the present time has divided both the military as well as the developers of the ASUV, regardless of whether they are wearing a uniform or not, whether they are representatives of the customer or the developer.

The first point of view, which is the official one at this time, belongs to the Chief of the General Staff, a hero of Russia, a four-star general, and political scientist, Nikolai Igorovich Makarov.

The second point of view belongs to his opponents.

In order to lay out the first point of view, I offer another citation from an interview between the current Chief of the Ground Forces, Colonel General Vladimir Valentinovich Chirkin, in *Krasnaya Zvezda* on June 1, 2012:

> Based on the demands of modern combat, at the tactical level of command the automated command and control systems of troops and weapons are insufficient. *The most promising trend in future development is the creation of software products that provide intellectual support for the tasks of the commanders of combined arms units and sub-units as well as for interaction with other forces.* (emphasis added)[106] "The high command of the Ground Forces is proactively working with enterprises and organizations that are developing combat management software. Many projects are considered to be promising and will be accepted."

I believe that the key to understanding the vision of the Chief of the General Staff and the Commander of the Ground Forces in regard to the role and place of the YeSU-TZ in executing C2 tasks are the words "creation of software products that provide intellectual support for the tasks of the commanders…"

What does the general have in mind when he says "intellectual support?" Translating from Russian into half-Russian the above phrase sounds like this: "The Sozvezdiye {the concern that produces the YeSU-TZ} software at the pres-

106 A direct quote was used by the author in the blogpost. "Vremya kachestvennykh preobrazovaniy [A time of quality transformation]", *Krasnaya Zvezda*, 1 June 2012, http://archive.redstar.ru/index.php/siriya/item/2648-vremya-kachestvennyih-preobrazovaniy, last accessed on 01 February 2020.

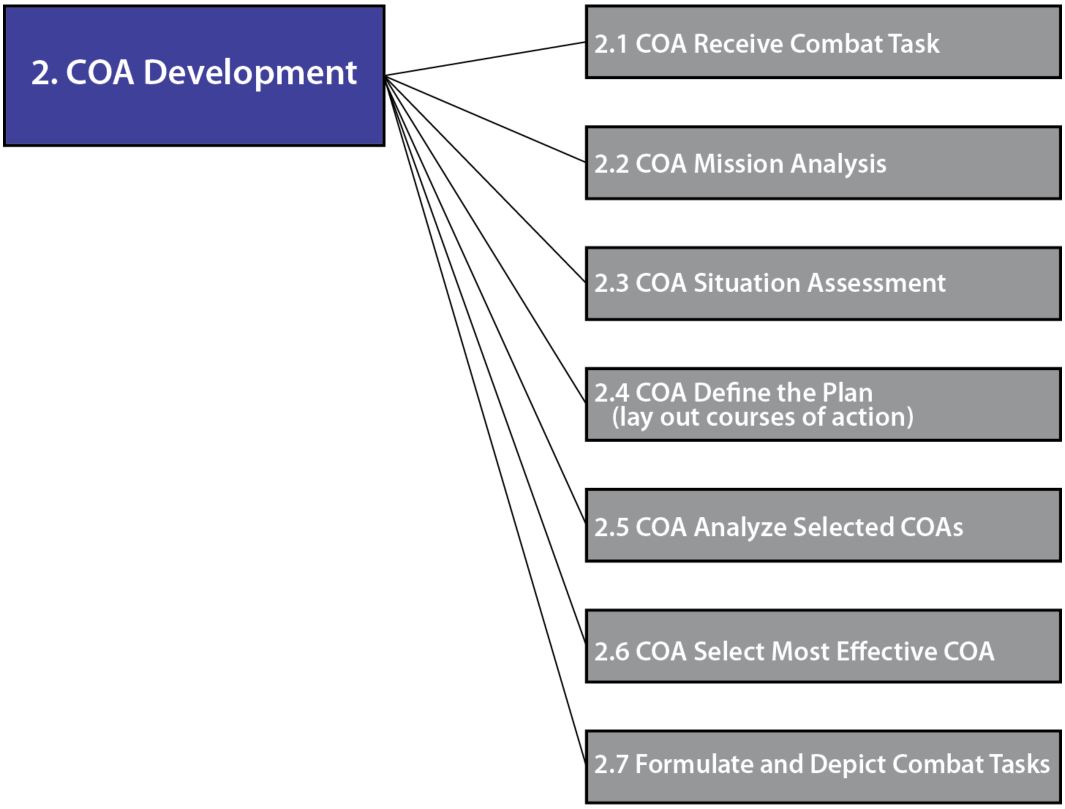

Fig. 13: Course of Action Development Tasks.

ent time does not rise to the level of a true C4ISR system, and we would like to have this level of system at the tactical level of the ASUV."

In this case, what is being considered is the execution by a machine in fully automatic mode of part of the information processes of the information task #2, "Course of Action Selection."

Now let's try and assess the scientific justification for the complaints of the generals and compare these complaints with the capabilities of the ASUV at its current stage of development.

To do this, from the entire list of information processes, we will consider the capability of the machine to execute only three:

2.4 Define the plan (lay out the courses of action)

2.5 Analyze selected COAs

2.6 Select the most effective COA

I suggest that this will be enough since the given processes are the key ones in the realization of the information task.

Not to tell you something you don't already know, but the automation of the given information processes requires an accurately formulated algorithm. That is, certain rules for the selection of courses of action to achieve the objective of the battle, an assessment and comparison of several courses of action, and the determination of mathematically accurate criteria of such an assessment, in order to create a decision matrix.

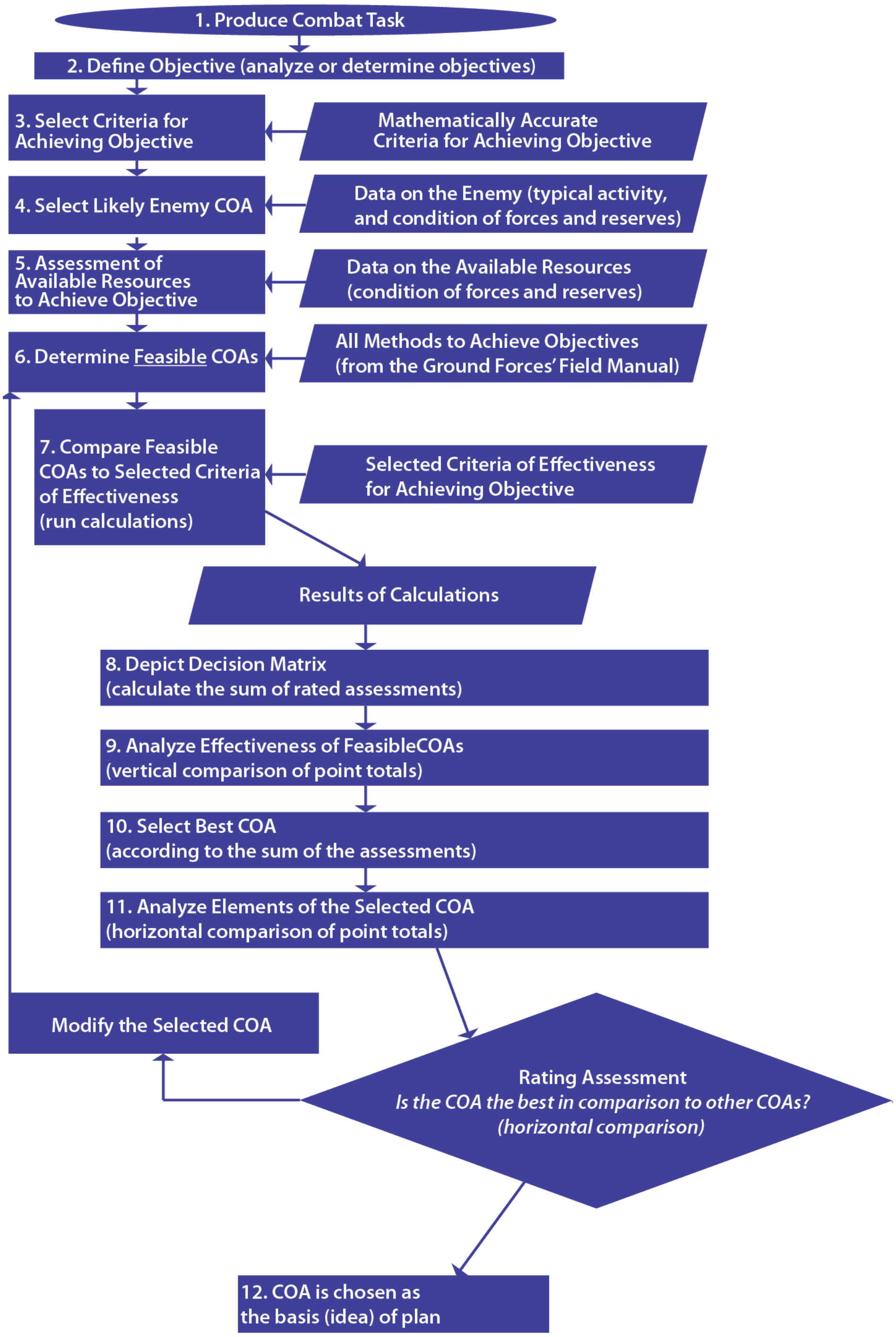

Fig. 14: Military Decision-Making Process Algorithm.

Let's envision the order of the work, which the commander's tasks follow in coming to a decision, in the form of an algorithm. The order of work is defined in the current field manuals and, therefore, is the official view of the military leadership.

However, in order not to fall under the watchful eye of relevant bodies [Russian Security Services], we will, to the greatest extent possible, simplify the sequence of work and will not present it as found in the field manuals, but rather in a form that is understandable to a layperson.

Having closely studied the given algorithm, we quickly understand that in running it with a machine, and not by a person, we immediately run into a whole series of problems.

First: The algorithm always assumes mathematically justified – and displayed in formulas and digital coefficients – parameters of bound values and criteria for assessing different courses of action.

Second: In order for the machine to correctly determine the optimal course of action, we need to accurately know the digital coefficients for various methods to carry out these combat tasks in various forms of battle with a varied enemy. That is, initially it is necessary to create a certain database of comparative assessments. Ideally, this information would be based on decisions that had already been made and executed in practice. Are you aware of many decisions of battalion commanders that have been executed in practice that have been thoroughly studied, and, moreover, mathematically calculated?

In other words, thus far at the tactical level (battalion and higher), military science has not been able to provide us with such calculated coefficients. I am talking about HONEST, justified coefficients – as they say in Hollywood, "based on actual events."

But let's suppose that we were able to somehow obtain such information and input it into a database.

Let's attempt to unpack the work of our algorithm in a "simple" example.

Suppose that our battalion has received a combat task to take some high ground on which an enemy unit has taken up a defensive position. Following the algorithm, we must first determine the objective of the actions before us. Thus, let's present the objective: take the high ground. By the way, in military jargon the phrase "seize" is used for such activity. Let's assume that we have managed to mathematically and tactically accurately depict the phrase.

Let's move on to selecting the criteria for achieving the objective:

These criteria can be quite varied. For example, time required to take the high point; inflict maximum damage upon the enemy; or, the opposite – inflict minimum harm upon the enemy and the population center that is on the high point (if there is a population center). The criteria can also be requirements to destroy the enemy without the use of, for example, nuclear weapons or some other type of weapon.

The bounded conditions for achieving the objective can also be the maximum allowable level of losses to own forces or the upper limit of ammunition expenditure, which is determined by a senior commander.

Let's suppose that we have managed to determine the criteria and, again, assume that we were able to put the criteria in a form that was mathematically accurate and understandable to the machine.

Having dealt with the criteria, we must also determine the most likely nature of enemy actions. For the sake of simplicity, let's assume that the enemy does not intend to attack us or to retreat from the high ground and decides to put up a stubborn defense.

In principle, the software should allow for the "branching out" of the algorithm based on a possible enemy course of action – which, by the way, greatly complicates running the algorithm. But we, mindful of the well-known Franciscan monk William of Ockham, will not unnecessarily complicate the matter and select the most probable enemy actions that were mentioned above.

Next. Having assessed the external conditions (weather, time of day, the NBC situation, terrain, the nature of the actions of our neighbors) as well as our own resources – that is, the time available for preparation, the quantity and degree of combat capability of our battalion, the availability of material reserves and many, many other things (all of which must be mathematically presented in accurate form), we select several courses of action that are realistic for us.

Where will we find these courses of action?

From the Combat Regulations [of the Ground Forces] (*Boyevoy ustav sukhoputnykh voysk*).

Such courses of action can be: a flanking attack with advancement from depth; attack from a position of direct contact with the enemy with a preliminary occupation of the starting position; attack with preparatory fires; night attack without preparatory fires (to achieve surprise); flank (sweep) from the right, from the left; vertical sweep (landing of airborne forces in the rear of the enemy defending the high point); etc. There could also be a combination of various tactical maneuvers.

Besides this, our battle formation could be in two echelons; or in one echelon with an allocated reserve; it could be set up in a linear fashion, backward "V" formation, forward "V" formation, etc.

The listed courses of action (and many others) to achieve the chosen objective (the construct of the battle formation, destruction by fires, and forms of maneuver) must also be mathematically depicted in accurate form (which doesn't yet exist, but we will not disrupt the dream).

Let's suppose that we (or the machine) have chosen four possible courses of action and have formulated them with the maximum degree of accuracy.

Now we must check the correspondence of each of these courses of action to the criteria and bounded conditions for achieving the objective. The results of the compared calculations (this, by the way, is a separate mechanism for comparison that needs to be depicted) are presented in the form of rated assessments, that is, a maximum value of the result of each calculation is given a numerical coefficient. Assume that the maximum positive value of such coefficients will be assessed as 5 points.

For optimal visualization of the results of the calculations we will create a table. Our "comrades" {a tongue-in- cheek way of referring to Americans, especially in a military context} call such a table a "decision matrix."

Having filled in the values of the criteria in the columns, we calculate the sum of the ratings of each COA.

We see that, for example, the first option has the highest point value.

Decision Matrix

No	Tactical Calculations	COA Options			
		1	2	3	4
1	Correlation of Forces and Means	5	3	2	1
2	Number of Critical Targets	5	3	2	1
3	Expected Probability of Locating Targets and their Amount	5	3	2	1
4	Capability of Destruction of Enemy Targets by Fires	5	3	2	1
5	Expected Losses	0	3	2	1
6	Probability of Mission Execution (temporary variable)	5	3	2	1
7	Distribution of Forces and Means	5	3	2	1
8	Required Consumption of Materials	5	3	2	1
9	Maneuver Capabilities of Sununits	5	3	2	1
10-40	Other Calculations				
	TOTAL POINTS	770	620	310	155

Fig. 15: Decision Matrix.

Decision Matrix

No	Tactical Calculations	COA Options			
		1	2	3	4
1	Correlation of Forces and Means	5	3	2	1
2	Number of Critical Targets	5	3	2	1
3	Expected Probability of Locating Targets and their Amount	5	3	2	1
4	Capability of Destruction of Enemy Targets by Fires	5	3	2	1
5	Expected Losses	0	3	2	1
6	Probability of Mission Execution (temporary variable)	5	3	2	1
7	Distribution of Forces and Means	5	3	2	1
8	Required Consumption of Materials	5	3	2	1
9	Maneuver Capabilities of Sununits	5	3	2	1
10-40	Other Calculations				
	TOTAL POINTS	770	620	310	155

Fig. 16: Decision Matrix (annotated).

Now we analyze the elements of the optimal COA, as it appeared (!), and compare each element (result of a calculation) with the other COAs.

For this we compare the values of the coefficients in the rows.

We see that the result of the calculation for assumed losses has in the first COA a value of "0." Translating from the language of numbers to military terminology: In executing the COA to achieve the objective, our losses exceed the allowable value. In other words, after the battle our battalion will not be combat capable.

Is this outcome of the battle acceptable to us?

If this outcome is not acceptable to us, then we must return to point #11 of the algorithm, that is, we return to correct the chosen COA (point #6).

In connection with this, it is important to understand that the insertion of any change into the chosen COA leads to a recalculation of the data and a subsequent change in the rated assessments and their totals. As a result, the results of the values in the decision matrix change.

This means that a cyclical process for choosing a COA will be repeated until an "optimal" COA is found from the perspective of the machine (or commander).

Or the software will provide a message that says that, given the conditions (criteria) and the available resources, it is not possible to achieve the objective.

Imagine the moral-psychological condition of the commander to whom the machine says, "No matter how hard you try, you will not achieve the objective of the battle." Moreover, in executing the combat task, the probability of personally surviving is equal to zero?!

Nevertheless, at the present time, there are programs for forecasting the course and outcome of combat actions that work according to the algorithm presented above. It is true that they were created for the resolution of tasks at the operational-strategic and operational level of command and control. However, as experience with the use of these programs during operational training exercises in the "high headquarters" has shown, the operational decisions made using the programs turn out to be rather generic, lack initiative, and are easily predictable (including by the enemy!).

In choosing the optimal decision with mandatory consideration of all factors, bounded conditions and criteria for achieving the objective of the operation, such programs, as a rule, produce decisions that follow the principle: "cover everything, give up nothing, and don't take risks."

But the tactical level is different from the operational level, involving a large diversity in employed tactical maneuvers, forms and methods of combat, as well as a combination of these! This leads to the presence of a practically limitless number of factors that influence the course and outcome of combat.

Summing up, in order to accurately create software that functions at the tactical level and is capable of actual (not just rhetorical!) intellectual support of the commander's decision-making process, it is necessary to clearly and accurately determine the numeric expectations of an enormous number of factors that influence the probability of executing the combat task in various situational conditions.

Furthermore, the training level of personnel, their moral-psychological condition and the degree of their fatigue, the ability to achieve surprise in action, the level of cohesion of the units and the closeness of their interaction all have a much more significant impact on the course and outcome of a battle at the tactical level as opposed to the operational level. Often times the significance of these factors is decisive.

How to mathematically depict given factors in an accurate way and then somehow collect and input information as factors change, I can hardly imagine.

Issues of "backfilling" are relevant to the following example:

How much (in numerical expectations) does a flanking attack against the enemy with two of our platoons increase the probability of achieving success in battle in comparison with an attack with one platoon?

In choosing a night attack as a course of action: What are the mathematical values of coefficients, given the possession by the enemy of night-vision equipment that is superior to our night-vision equipment, if the course of action selected was a frontal assault at night? In terms of numerical values, what could be considered in calculating the probability of achieving the objective of the battle?

Or, how would enemy special operations personnel operating at our rear influence the course and outcome of the battle? In numbers and values of coefficients?

Unfortunately, thus far neither military science nor I have answers to these questions.

But, let's suppose that we (that is, military science, of course!) have completely figured out the numeric values and can mathematically express them in an accurate fashion.

However, if we look at the automation of the process of coming to a decision from the point of view of reducing the combat command and control cycle, even given these conditions, the state of affairs doesn't look that great.

Can't you see! The existing norms that determine the temporal parameters of the work of the commander and his staff in working through a decision presuppose the operationalization of the given information process in very limited timeframes.

Thus, in the course of determining the overall concept, which is directly related to the running of the calculations, the modeling of combat actions, as well as the selection of the optimal course of action from the group of options, the following time is allotted (see fig. 17).

From "S" + 1.20 to "S" + 1.55. That is, only 35 minutes. The temporal parameters provided are for the non-automated work of the commander and HQ staff of a brigade.

And over this time period it is necessary to "calculate" each of the COA options (each of which has approximately 40 parameters)!

Will we make it in time?

In my view, even with the application of machine-based software systems, it is quite difficult to execute the given task in the allotted timeframe.

From my perspective, the approach to resolving issues related to the selection of the optimal course of action by focusing on running calculations of the correlation of forces of the sides (even with the consideration of their combat potentials), is a dead end.

Military history is full of examples when combat tasks at the tactical level were successfully executed without achieving quantitative superiority in personnel, weapons and equipment (even in the direction where primary forces were concentrated or in the direction of the main strike).

As experience from military conflicts over the past few decades has shown, success (especially at the tactical level) can be achieved first of all through:

Efficiency of command and control (relating to delivering combat orders to subordinates).

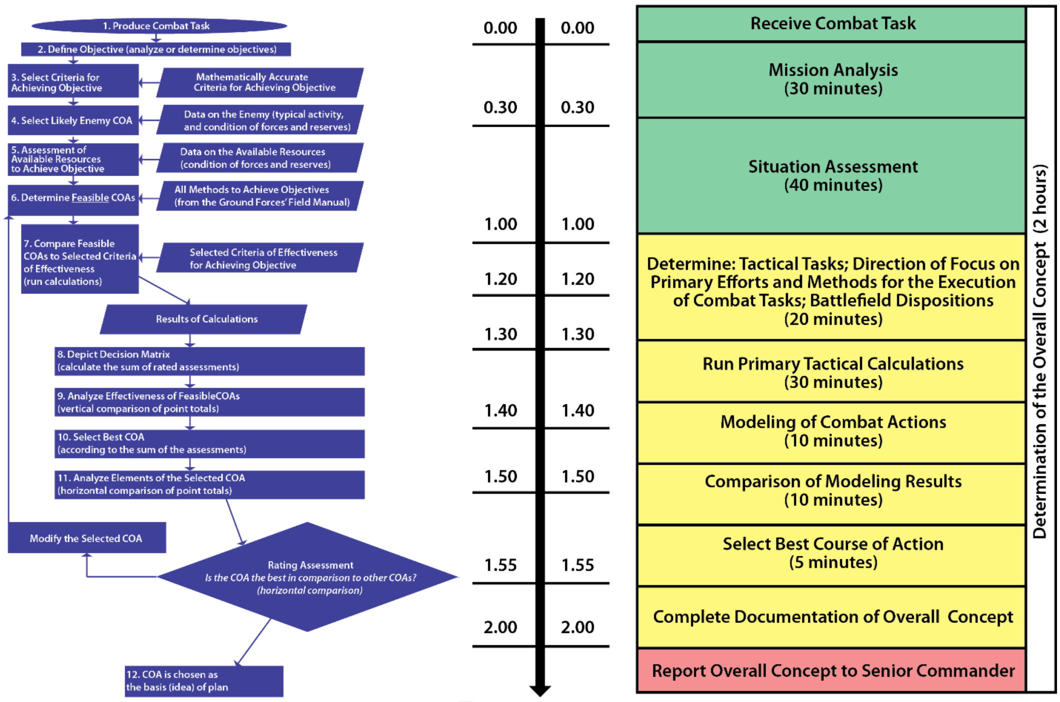

Fig. 17: Military Decision-Making Process Algorithm (time comparison).

Advantages in situational awareness of all elements of the order of battle in the course of combat; that is, a higher level of fidelity of information than the enemy has on the elements of the combat subsystem in a developing situation and on the disposition of forces of each side.

As a result of points 1 and 2: An increase in the reaction time of the entire combat system to situational changes.

As those same Americans say: "Better to have a good plan today than a perfect plan tomorrow!"

The obsession of our generals with attempts to transfer the work of running through options for a decision at the tactical level of command and control to the "shoulders" of a computer (leaving to the commander only the function of choosing from the proposed options), is, in my opinion, futile and indeed harmful.

Such an approach will lead to:

Incredible complexity added to already complex application software at the user level.

The need to create within the framework of the Automated Troop Command and Control System subsystems for the constant collection, updating, and storage of all possible mathematically depicted data that are required for the computer to work through the various options for a decision (for example, on ensuring that each combat weapon has sufficient ammunition in real time). In connection with this, the creation of such subsystems will add an unjustified expense to already expensive automated command and control systems.

However, without the creation of such subsystems for the automatic collection of necessary data, the mathematical modeling of combat actions (which, in the absence of such data, will be conducted without consideration of a wide range of factors that influence the course and outcome of the battle) will provide an extremely unreliable "picture" of such combat and will negatively impact the quality of combat decisions that are made.

The current approach to resolving tasks related to the "intellectual support of a decision" will force the computer to repeatedly process all the necessary data (for several options in a very limited amount of time). This, undoubtedly, will lead to the construction of programs of such complexity that the requirements of these programs will clearly exceed the capabilities of current and even future means for transferring, processing, and storing information that can be used in the military command and control system.

As a result of their work, the programs, which are "tied to" the combat potentials of the forces of the opposing sides and the extent of their resource support, will always show the insufficiency of these resources for the qualitative execution of combat tasks. And, as a result, they will provide information on the impossibility to achieve combat objectives with the assets on hand. This is extremely harmful to the moral-psychological condition of officers of the staffs of military command and control.

The programs that are built on such an algorithm will, as a priority course of action, consider the concentration of resources in the direction of the main strike or in the direction where the primary enemy forces are concentrated, which at the tactical level is not always justified.

There is, however, another point of view on the path toward developing military automated systems of tactical command and control. Efforts to improve the material-technical equipment and software for tactical command and control systems must be directed by no means at the replacement of the mental activity of the commander with work carried out by even the most advanced computer.

In the initial plan, critical issues are: expediting the delivery (to subordinates) of combat tasks that have been worked out by a HUMAN; the mutual informing of elements of the combat system on the developing situation; the discovery, identification and transfer of information on the most important, critical (vital for the enemy) targets, the destruction of which would disorganize his command and control system and disrupt interaction such that elements of his combat subsystem are isolated from one another. It is this, in the final analysis, that should allow us to defeat even a stronger enemy.

From this perspective, the combined arms and artillery correlation of forces will not have the decisive significance in modern battle that is currently believed.

Consequently, priority in the creation of software for tactical command and control should be given not to the realization of "toys" that model combat conditions, but rather to the writing of such programs that would many times increase the speed of displaying the decisions made by commanders (not computers!), provide the "freshest" situational data, and transfer (distribute) all of this information between subsystems (command and control points) and elements of the combat system.

Thus, the second point of view (that of the opposition) is based on the fact that, in the absence of a capability (for a number of reasons) to immediately create a true C4ISR system at the tactical level, it is necessary to initially focus on the creation of a NORMALLY FUNCTIONING C2 system. The letters 'ISR' can be added according to one's preferences.

Conclusion:

The slogan "Pass, not catch up," which was put forth by the respected chief designer of the YeSU-TZ, Potapov, has not been realized.

Therefore, for me personally the YeSU-TZ would involve the following:

1. Reduce the level of requirements for the system from the "atmospheric heights of the General Staff" to what was originally offered (but unformulated) in the initial technical assignment of the class of C2.
2. Within the framework of the class of C2, bring the software up to an acceptable (for reasons of necessary sufficiency) level of display quality and speed of displaying the tactical situation considering the execution of requirements laid out here: http://dragon-first-ru.livejournal.com/35985.html. In connection with this, use pilot projects in the area of software of third-party designers – in this General Chirkin is absolutely correct!
3. Use existing assets for processing and transferring data assuming their constant improvement. This includes the installation of additional sets of VHF radios on maneuver armored objects and an increase in the number of VHF communication channels.
4. Simultaneously work on the creation of radio stations and radio networks in the radio frequency range using MESH technologies. In the future, transition to those technologies and move away from the frequency range of 1.5 - 1.75 GHz.
5. Develop algorithms for use (the sequence of work of the commander and staff) of the system based on the results of the practice of troops, and not "by diktat." Let me remind you that the weapons used (means of command and control) determine the tactics of conducting combat operations (methods of command and control), and not vice versa.
6. Finally, connect all subsystems and objects in them using a unified software and formats of the transmitted (processed) data.

ANNEX B

Automated Command and Control Systems: Computers and Communications

The desire to field an effective Automated Command and Control was first put forward by the Soviets, but technological limitations regarding computers and communications stifled these ambitions. In recent years, the Russians, and especially the Russian Armed Forces, have made great advances in these areas. Although by many measures the Soviet military lagged behind the West, the same cannot be said of the Russian military today. Due to security reasons, the Russians are keen to develop their own computers for the government and security services. These domestically produced computers almost certainly contain foreign made components, especially microprocessors, but are assembled in the Russian Federation. (Apparently, Russia believes it can mitigate some of the risks of foreign components in the supply chain by diversifying its supply chain). These computers are produced by a consortium of different manufactures under the management of the Sozvezdiye Concern in accordance with the customer requirements. But it is clear there is some sort of standardization mechanism to ensure the interoperability of components. Military-grade notebook computers are designed for field conditions, and are so encased in a machined, all-metal aluminum case that helps protect the computer from vibrations, shocks, water, dust, and can reportedly remain functional at a temperature of – 40 to + 50° Celsius. (The notebooks can also be equipped with a vibration-absorbing base and an airtight plastic case for additional protection.) These notebook computers are presumably the nodes of the network, or 'brains', of the Automated Command and Control system at the tactical level.[107]

Russia has long been suspicious of foreign, especially American-produced, operating systems for use in handling classified information for its military, intelligence, and security services. And since the key components of any C2 system are the individual computers and their operating systems, Russia has made great efforts to develop a domestic operating system. Since at least 2002, Russia has fielded domestically produced operating systems for government use. These systems had limited capabilities until the Zarya computer operating system was fielded around 2015. The Zarya operating system appears to be a family of operating systems for desktop computers/laptops, servers, and mobile devices. It has also been designed to work in conjunction with the new Russian military identity cards, which have a chip for encryption purposes, and for storing personal and medical data.[108]

107 Khudoleyev 2019.

108 "Zashchishchennaya ot shpionazha operatsionnaya sistema 'Zarya' gotova poyti v seriyu [New secure operating system 'Zarya' is ready for series production", TASS, 24 September 2015, http://tass.ru/armiya-i-opk/2286904. "OPK: VMF v 2016 godu poluchit pervyye kompleksy svyazi shestogo pokoleniya [United Instrument Corporation: Navy will receive first sixth-generation communication systems in 2016]," RIA Novosti, 30 Decem-

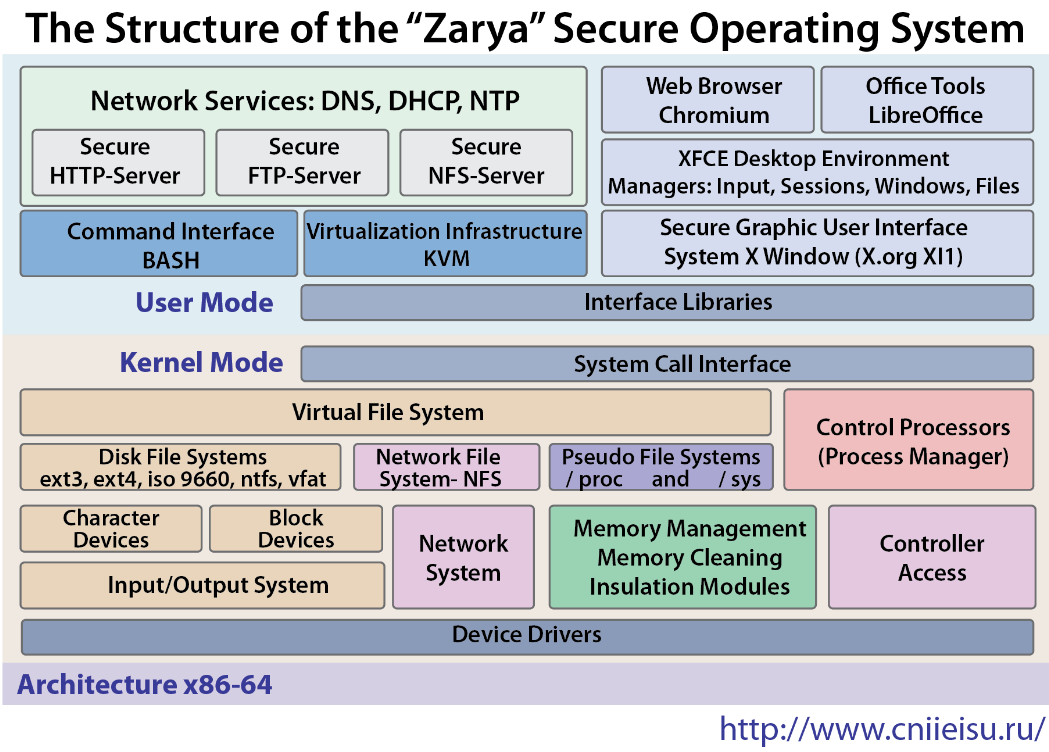

Fig. 18: Structure of the 'Zarya' Secure Operating System.

Zarya is a development of the Armed Forces Mobile System (MSVS) (*mobil'naya sistema vooruzhonnykh sil*) architecture that is a private multiuser multitask operating system with time sharing, developed by the "All-Russian Scientific Research Institute of Control Automation in the Nonindustrial Sphere named for V.V. Solomatin". MSVS is Linux-based, POSIX (Portable Operating System Interface) compliant, and based upon a 64-bit architecture. In 2017, the 3.0 version of the MSVS operating system (presumably a successor of the Zarya) received the test laboratory's endorsement and was later certified by the Russian Armed Forces General Staff Eighth Directorate. MSVS 3.0 provides a multilevel system of priorities with preemptive tasking, virtual organization of memory, and network support. Automated Command and Control software such as Andromeda-D, *Akatsiya-M* or the Integrated Tactical Echelon Command and Control System (YeSU-TZ) is installed on this operating system, permitting the operator to plan and execute operations and leading to an increase of the efficiency of troop command and control.[109]

Although Russian Automated Command and Control Systems are, as a rule, not intended to be connected to the Internet, the Russian Armed Forces are still greatly concerned about the impact of computer viruses and malware. This is because there is a fear that unwanted code could potentially be introduced through wired and radio data transmission links. Once the network is breached,

ber 2015, http://ria.ru/interview/20151228/1350434123.html, last accessed on 01 February 2020.

109 Khudoleyev 2019.

hostile code could destroy and/or corrupt databases, tap conversations, disrupt the operation of the Automated Command and Control System, and even issue orders. In order to mitigate these risks, the Russian Armed Forces are reportedly employing encrypted communication links and specialized antivirus software. This antivirus software is installed on all computerized components of the Automated Command and Control System to include servers, notebook computers, and encryption equipment.[110]

Russian military communications in the Ground Forces have come a long way from simple audio and visual methods for transmitting combat command-and-control orders to advanced multichannel automated systems that provide real-time communication with fixed and mobile facilities at practically unlimited range. In practice, this means the Russian Ground Forces' once notoriously unreliable communications (especially at the tactical level) have been much improved. In terms of organizational structure, the radio communication system of the Russian Ground Forces can be provisionally divided into two main parts. The first is High Frequency (HF) systems that operate using the principles of ionospheric radio wave propagation and have transmitters of 500 Watts or more. These systems are designed to provide long range, over-the-horizon communications for operational and strategic level control. (Although the Ground Forces do have satellite communication capabilities, the bandwidth is evidently in short supply, as HF appears to be the primary means of over-the-horizon communications.) These radios currently consist of several large families. The R-161 Poisk family was widely fielded in the 1980-1990s, and has since been replaced by the R-166 Artek family, which was developed in the late 1990s. The R-176 Antey family is the next generation of the Russian Ground Forces' long range, over-the-horizon radios for operational and strategic level control. Among other technological innovations, the R-176 Antey family is reportedly a Software Defined Radio (SDR), meaning a radio that is primarily manipulated through software instead of hardware such as mixers, filters, modulators/demodulators, etc. These types of radios are capable of receiving and transmitting different waveforms based solely on the software used, instead of requiring physical modifications of hardware.

The second main part of the Ground Forces' communications consists of low-power mobile, portable, or transportable VHF/UHF radio communication systems that have power up to 100 Watts and are used for tactical purposes. Currently the R-168 Akveduk, Russia's fifth-generation tactical radio system, is currently the primary tactical radio in service with the Ground Forces, Airborne, and Naval Infantry. These radios, widely fielded in the late 2000s, provide capabilities for digital data transmission and resilience against jamming. Although the R-168 Akveduk was a major advancement over the previous Arbalet series, the Akveduk man-portable radios were too bulky for convenient dismounted use. Russia's newest tactical radio system is the R-187 Azart family. Aside from other advancements, the R-187 is also an SDR radio that has digital data trans-

110 Ramm/Kozachenko/Stepovoy 2019.

mission, encryption, and electronic warfare resilience capabilities. Unlike the R-168 Akveduk family that consists of over 20 different radios, the Azart family has only three radios: the Azart-P (4km), Azart-N (12km), and Azart-BM (40km). The first reports of the R-187 Azart entering service began in 2012, and it has reportedly been used in the Crimea, Eastern Ukraine, and Syria. Interestingly, the Russians have reportedly already fielded a UAV-based repeater to extend the range of the system.[111] If computers are the 'brains' of an ASU, the communications network that links them together is the 'backbone'. Although the R-166 and R-168s are still the predominant operational and tactical communication systems in the Russian Ground Forces, the fielding of the R-176 and R-187s will significantly enhance Russian Automated Command and Control capabilities by ensuring resilient and secure communications capabilities. It should also be noted that although terrestrial radios, and to a lesser extent satellite radios, are the primary links of any tactical Automated Command and Control System, fiber optic cable is also used in appropriate situations.[112]

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111 Colonel General Khalil Arslanov: Arslanov 2019.

112 Avdeyev 2018.

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