LAWS OF MILITARY CYBERNETICS

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Abstract. Military cybernetics is a science concerned with the organization and management of military, special, and border guard systems, providing quantitative decision support for commanders (leaders) and headquarters (command and control bodies). This paper considers the composition and structure of military cybernetics. The laws and principles of military science are briefly reviewed and systematized to formulate the general laws of military cybernetics. These include the following: 1) the law of dependence of the goals and results of armed struggle on the policy and capabilities of the state (economics, science, and technology); 2) the law of uncertainty (a true uncertainty arising during tactical-level combat operations and special actions, and a measurable uncertainty arising at the operational and strategic levels); 3) the law of adaptive combat systems (the emergence of new weapon systems leads to changes in organizational structures, tactics, and the development of adequate counteracting means, in terms of performance and cost characteristics). Promising areas of further research include expanding the scope of the laws of military cybernetics and their use in modeling armed struggle and combined arms operations.

Keywords: laws, regularities, principles, cybernetics, military science, military cybernetics, organization, management, armed struggle, combined arms operations.

In war, everything is simple, but the simplest things are the most difficult.

C. Clausewitz

INTRODUCTION

Recent years have been remarkable for a resurgence of interest among scholars and practitioners in both general cybernetics (the philosophy of control, the "standard of thinking," and the science of system organization) and sectoral cybernetics: technical (engineering cybernetics), biological, socio-economic, military, and others [1]. While general cybernetics formulates laws, regularities, and principles of functioning for complex systems and their control, sectoral cybernetics is more applications-oriented. For example, works in the field of military cybernetics (see the monograph [2], *Chapter 1*) are primarily devoted to particular control problems for military and combat systems (operations research), almost not addressing the issues of formulating and justifying general regularities of management processes for armed forces.

In this paper, we justify the laws (regularities) of military cybernetics. The presentation is organized as follows. Section 1 introduces basic concepts and terms. The structure of military cybernetics is considered in Section 2. Next, Section 3 is devoted to an overview of the general laws of cybernetics. In Section 4, we briefly review the laws, regularities, and principles of military science. Based on the above results, the laws, regularities, and principles of military cybernetics are systematized in Section 5. This provides grounds for treating military cybernetics, first, as a science concerned with the organization and management of military, special, and border guard systems, and, second, as an integrative science—a general methodology for studying the organization and management of military systems.

1. BASIC TERMS

Let us define the related notions and discuss their conceptual content.

Laws, regularities, and principles. According to the Encyclopedic Dictionary [3], a *principle* is a fun-

damental, basic premise of a theory or doctrine; a guiding idea or fundamental rule of activity.

A *regularity* is a permanent cause-and-effect (causal) relation between phenomena and processes.

A ***law*** is a necessary, essential, stable, and repetitive relation between phenomena.[1]

Cybernetics is the science of control and communication in the animal and the machine (in the words of Norbert Wiener[2], the father of cybernetics) or the science of the organization and control of systems [1].

An alternative definition of *Cybernetics* (with capital C, to distinguish it from cybernetics where confuse may occur) is "the science of general regularities of control and data processing in animals, machines, and society" [1]. The second definition differs from its first counterpart in the words "general regularities," which is crucial. In the former case, the matter concerns "the umbrella brand," i.e., the "integrated" results of all sciences dealing with problems of control and data processing in animals, machines, and society. The latter case, figuratively speaking, covers partial "intersection" of these results, i.e., usage of common results for all component sciences.

Military cybernetics is the science of organizing and managing military, special, and border guard systems, providing quantitative decision support for commanders (leaders) and headquarters (command and control bodies) [2].

Here, it is reasonable to consider military, special, and border guard systems in a unified manner, despite the current state-level departmental fragmentation of the latter.

Since the subject matter of military cybernetics encompasses military, combat, and special systems, the principles of military science must be taken into account when formulating its laws. According to the Great Russian Encyclopedia, *military science* is the system of knowledge concerning the laws, regularities, and principles governing the emergence and prevention of military conflicts, their preparation and conduct, as well as the construction and preparation of the armed forces and the country for war, methods of conducting armed and other forms of combat (including informational confrontation), and ways to prevent war and ensure national security. The modern structure of military science distinguishes between the general foundations of military science, the theory of military art (as a unity of its three parts), the theory of constructing armed forces, and other theories.[3]

Consider the relationship between military cybernetics and military science, technology, and art. A *technology* is a system of conditions, forms, criteria, methods, and means for solving a posed problem. Today, technologies standardize *craft/skill*[4] and *art*[5] via identification and generalization of best practices; creation of technologies requires appropriate scientific grounds (Fig. 1).

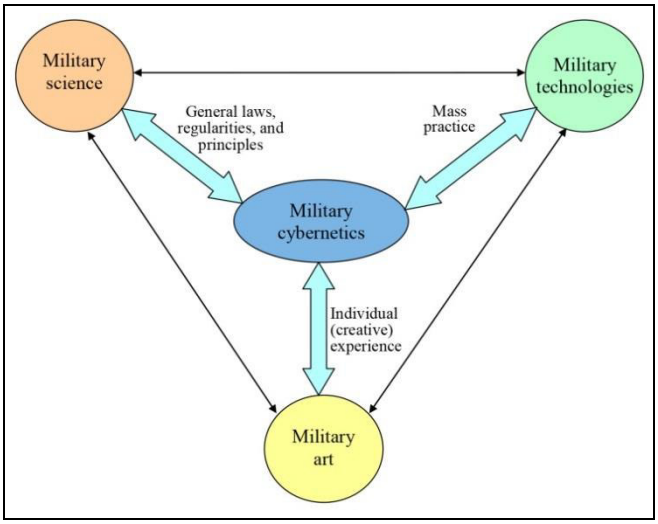

Fig. 1. Military science, technology, and art.

One should discriminate between military science (including the theory of military art), contributed by Sun Tzu, C. Clausewitz, G.A. Leer, V.K. Triandafilov, G.S. Iserson, I.M. Kapitanets, and many others, and military art (the activities of outstanding military commanders: Julius Caesar, A.V. Suvorov, Napoleon, M.I. Kutuzov, G.K. Zhukov, and others, who left an indelible mark on world history; military researchers draw inspiration from their leadership when studying wars and battles)[6].

[1] According to Russian military theorist G.A. Leer, a systematic body of laws, accompanied by their explanation and analysis, preceded by an investigation of the properties of the elements and their mutual influence, constitutes a *science*. The application of these laws to the infinitely diverse conditions of life—a matter of ability lying outside the sciences and above them—is already an *art* [4, *p. 16*]; also, see Fig. 1).

[2] Cybernetics (from the Greek κυβερνητική "governance," κυβερνώ "to steer, navigate or govern," κυβερνη "an administrative unit; an object of governance containing people") is the science of general regularities of *control* and *information transmission* processes in different systems, whether *machines*, *animals*, or *society* [5].

[3] Military Science. URL: https://bigenc.ru/c/voennaia-nauka-bb19e9 (Accessed December 20, 2025.)

[4] A craft is a personal skill of routine operations based on experience.

[5] Art is a system of techniques and methods in some branch of practical activity; the process of talent usage; an extremely developed creative skill or ability.

[6] Throughout this paper, the terms "military art" and "practice of military art" are understood as synonyms.

Military technology refers to the application of technology for military purposes. Military cybernetics operates on the basis of the general laws, regularities, and principles of armed struggle and preparation for it, as developed by military science. As a science of the organization and management of systems, military cybernetics investigates the influence of individual (creative) experience and mass practice on the course and outcome of armed struggle and military development (particularly using, but not limited to, methods of military statistics). For example, an important task of military science and military cybernetics is to find an optimal balance between centralization and decentralization (centralized planning and decentralized execution).

2. THE STRUCTURE OF MILITARY CYBERNETICS

Military cybernetics was originally defined as the science that studies the general regularities of management processes for armed forces, military equipment, and weapon systems to increase the effectiveness of their combat use [6, *p. 448*].

In his 1972 book, Yu.N. Sushkov noted that all areas of military application of cybernetics are sometimes grouped under the term "military cybernetics" [7]. However, in his view, the scope of this term has narrowed recently. For example, automatic control systems for military devices fall within technical cybernetics since their military specifics are insignificant in cybernetic research. Consequently, the domain of military cybernetics is the study of command and control processes for armed forces using cybernetic methods. Algorithms for managing armed forces in battle are one of the main subjects of research in military cybernetics [7, *pp. 11, 12*].

There exist several established traditions for using the term "cybernetics" and the prefix "cyber-" in the field of defense and security. The first meaning is the one mentioned above, and it will be primarily employed in this paper.

The second meaning ("military information science") emphasizes data transmission and processing; it encompasses everything related to information technology and the use of computers and infocommunications to command and manage armed forces, etc. [8]. Cyberwarfare can also be included here [9].

The third meaning of the prefix "cyber-" relates to networks and decentralized data exchange within the conceptual framework of network-centrism[7] [10].

Sometimes, artificial intelligence—a very popular topic nowadays—is also attributed to cybernetics; see the reviews in [11, 12].

Military cybernetics can also include branches of technical cybernetics, i.e., those of control theory (particularly automatic control) dealing with control of weapon systems, military equipment, and special equipment.

Historically, operations research was considered part of cybernetics; therefore, the corresponding mathematical models [2, 7, 13, 14] are also included in military cybernetics.

Thus, military cybernetics, viewed as the umbrella brand, encompasses many disciplines (Fig. 2a).

The general laws (as well as principles and regularities) of organizing and managing military, special, and border guard systems are the subject of military Cybernetics (with capital C), see the umbrella ribs in Fig. 2a (top view). The relations between them are shown in Fig. 2b.

3. THE GENERAL LAWS OF CYBERNETICS

The general laws of cybernetics are well known [1]. (Some researchers refer to them as principles.)

A. *The law (principle) of feedback* (cause-and-effect relationships);

B. *The law of requisite variety* (sometimes called the adequacy principle stated by W. Ashby): the variety of a controller must be adequate to the variety of a controlled object;

C. *The law of synergy*, fundamental in systems theory: the whole is greater than the sum of its parts (Aristotle); in other words, the properties of a system cannot be reduced to the "sum" of the properties of its elements;

D. *The law of purposefulness*: each control system has a goal;

E. *The law of external complementarity* formulated by S. Beer (the so-called third principle of cybernetics): any control system needs a black box, i.e., certain reserves for compensating for the disregarded impact of external and internal environments;

F. *The law of optimality*: a control action must be "best" in terms of achieving the goal under existing constraints.

The above list is often accompanied by the following principles: causality, decomposition (analysis), aggregation (synthesis), hierarchy, homeostasis, and consistency (prior to control design, consider the problems of observability, identifiability, controllability (including stability), and adaptability) [1].

All the laws mentioned are, of course, valid for military cybernetics; and these general laws lead to unique partial laws for military cybernetics (see Section 5).

[7] This text uses particular abbreviations related to cybernetics and control theory: C^3I—Command, Control, Communications, and Intelligence; C^4I—Command, Control, Communications, Computation, and Intelligence; etc. [1].

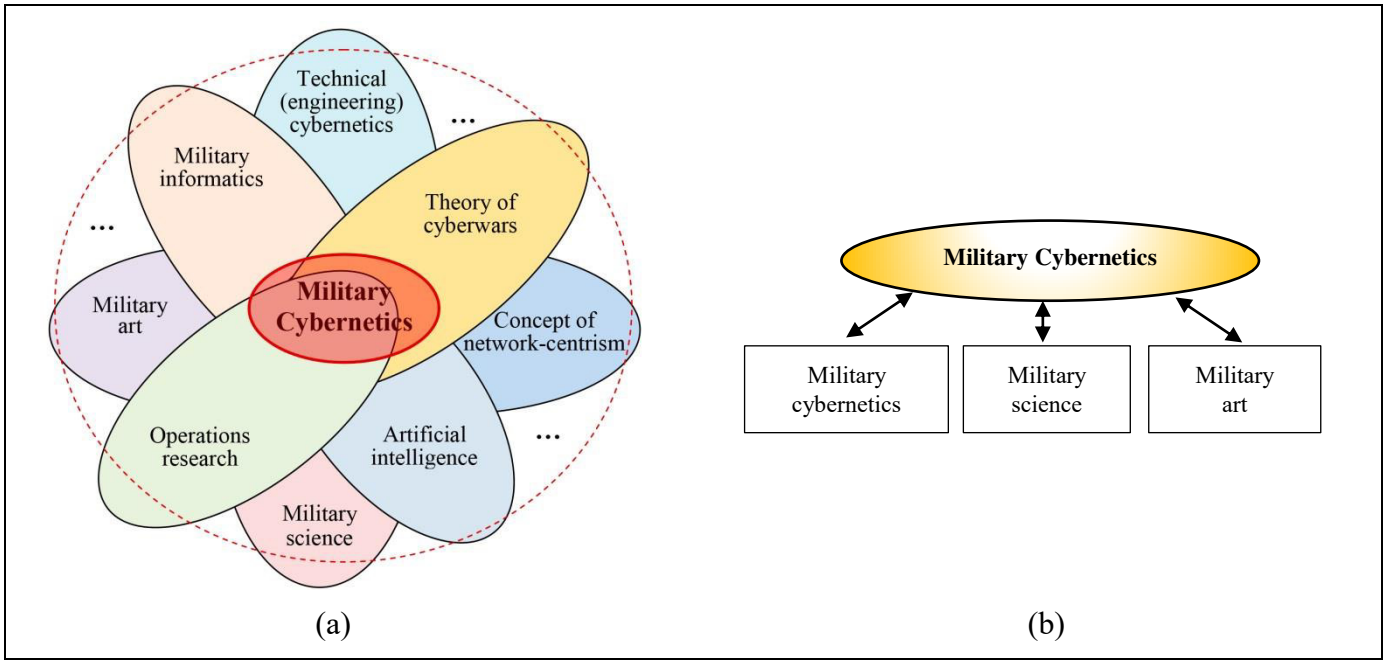

Fig. 2. The composition and structure of military cybernetics: (a) components of military Cybernetics and (b) the relationship between military Cybernetics and cybernetics.

On the other hand, note that no laws of military cybernetics have been formulated so far. (The extensive literature on military cybernetics—see the review in the monograph [2]—should rather be classified as operations research, which relates to cybernetics in the terminology of the book [1] (Fig. 2); and there are almost no works on the general laws of military cybernetics.)

4. THE LAWS, REGULARITIES, AND PRINCIPLES OF MILITARY SCIENCE: A BRIEF REVIEW

Numerous works have been devoted to studying the laws, regularities, and principles of military science and its components, ranging from classical textbooks [4, 15, 16] (see a brief review in the paper [17]) to contemporary publications [18–22].

While emphasizing the importance of strict discipline in armed forces and maintaining their morale, Sun Tzu's *The Art of War*—an ancient Chinese treatise—formulated *the following fundamental principles of military art* [23]:

1) "The greatest victory is to win without fighting": the best outcome is to break the enemy's resistance without resorting to combat, thereby preserving the enemy's state and army.

2) "All warfare is based on deception": conceal your true intentions, pretend to be weak when strong, and vice versa.

3) Speed and cost-saving: "There is no instance of a nation benefiting from prolonged warfare"; long wars exhaust the state. War favors victory and dislikes duration.

4) Study of the Five Fundamental Factors: "The art of war is governed by five constant factors, to be taken into account in one's deliberations... These are: (1) The Moral Law; (2) Heaven; (3) Earth; (4) The Commander; (5) Method and Discipline."

5) Managing the enemy: "Hold out baits to entice the enemy. Feign disorder, and crush him."

6) The principle of invincibility: "Invincibility lies in the defense; the possibility of victory in the attack."

7) Use of espionage: "Thus, what enables the wise sovereign and the good general to strike and conquer, and achieve things beyond the reach of ordinary men, is foreknowledge."

8) Flexibility of tactics: "Water shapes its course according to the nature of the ground; the soldier works out his victory in relation to the foe whom he is facing." Act according to the circumstances; do not follow rigid patterns.

Figure 3 shows the Leer's main elements of military science and art [4, *p. 24*].

He defined the moral element as the mind and heart of the army and nation for their participation in war [4]. This element is the subject of research in military psychology according to Leer and in military sociology according to N.N. Golovin [24]. Note that Golovin

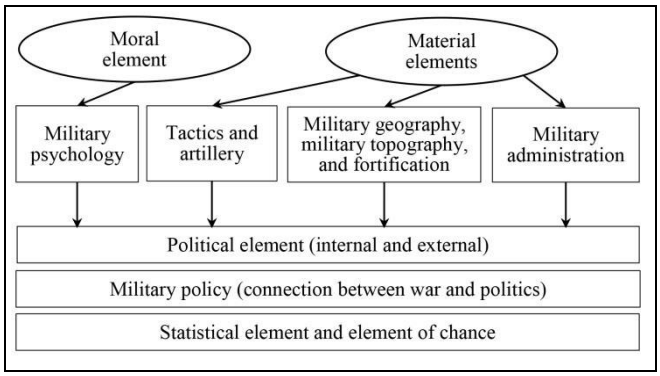

Fig. 3. The main elements of military science and art (G.A. Leer).

distinguished between *the science of war* (the so-called sociology of war), which seeks to discover general laws, and *the science of conducting war* (the theory of military art), which generalizes military experience into principles [24, *p. 22*].

The subject of military administration is to investigate the most advantageous methods of recruiting, forming, organizing, and generally supplying armed forces with everything necessary for life and combat [4, *p. 21*].

From Leer's viewpoint, the objective of military statistics is to assess the strength of armed forces (all other elements, see Fig. 3). Chance and uncertainty must be taken into account in military science and practice. According to Napoleon, "any undertaking is well planned if two-thirds of the plan is based upon calculation and one-third upon chance. He who wishes to take no chance in war had better not undertake anything" [4, *p. 22*].

Now we recall some **laws of military art** formulated by Leer[8]:

– War cannot serve as an end in itself, but is merely one of the means—and, moreover, an extreme means—in the hands of politics for achieving state goals.

– The system of military institutions of a given state must be strictly aligned with its forces and resources, and, more generally, with the degree of its wealth.

Such laws are usually postulated, and historical examples are provided to substantiate them.

According to Admiral I.M. Kapitanets [25], the main component of military science is the theory of military art (tactics, operational art, and strategy). Military science also includes the theory of constructing armed forces, the theory of commanding them, the theory of military training and education, and the theory of armaments and military equipment.

The system of laws of war and armed struggle formulated in the book [25] consists of general laws of war and partial laws (laws of armed struggle).

The first group of *general laws of war* [25] postulates how the course and outcome of war depend on:

– the economic capabilities of the warring parties (belligerents),

– the political and moral state of the population and the army,

– the scientific capabilities of the belligerents, and

– the actual military capabilities of the belligerents.

The second group of *general laws of war* reflects how:

– the course and outcome of war and armed struggle depend on the policies of the belligerents,

– the methods and forms of armed struggle depend on the characteristics of weapons, military equipment, and the combat skills of military personnel.

Partial laws of war (armed struggle) [25] include:

– the dependence of the course and outcome of a battle (operation) on the balance of combat power between the belligerents,

– the dependence of the course and outcome of a battle (operation) on the concentration of the belligerents' main efforts on the principal direction,

– the interconnection between combat operations at the strategic and operational-tactical levels.

As identified in the book [25], there are seven partial laws of armed struggle, occupying an intermediate position between regularities and principles. Kapitanets noted that at different historical stages, some laws cease to be relevant, whereas others may undergo transformation. He also described the process for transforming a law or regularity into a tool for the practical activities of commanders, officers, and personnel: "law—principle—army regulations—standards—calculation methods" [25].

According to the textbooks on tactics [26, 27], manuals [28], and other literature [25, 29], the main **principles of combat** are as follows[9]:

I. The *principles of motivation*, which are immediate from the nature of armed struggle ("War is an act of violence to compel the enemy to fulfil our will" [15]) and from the theory of activity organization ("An activity is a purposeful action of a human" [31, *p. 4*]):

1) the full mobilization of moral and physical strength, and the use of moral and psychological factors to accomplish combat missions;

2) permanent combat readiness.

[8] Other Leer's laws are rather principles of the art of war or have lost their relevance by now (e.g., the law regarding the ratio of firearms to bladed weapons).

[9] G.K. Zhukov identified the same "fundamental issues" (principles) that influence the success of a skirmish, battle, or operation (at the tactical, operational, and strategic levels) [29]. The principles of military strategy were outlined in the book [30].

II. The *principles of armed forces management*:

3) firm and continuous command of armed forces;

4) coordination of the combat tasks of units and subunits with their combat capabilities (according to Zhukov, precise calculation of forces and resources: "the practice of setting impossible tasks yields nothing but losses, the depletion of forces, and the undermining of morale" [29]);

5) organizing and maintaining continuous interaction;

6) the principle of simplicity [28]. Instructions, plans, and orders must be as simple and straightforward as possible. Objectives and actions must be presented in clear, concise, and understandable terms. At the tactical level, the simplicity of plans and instructions contributes to the successful conduct of operations and reduces the chance of misunderstandings and confusion. *Ceteris paribus*, a simple plan executed quickly is preferable to a complex plan executed too late. Simplicity resolves the fog of war and the complexities of warfare, helps commanders and their staffs maintain a common understanding, and takes into account the nature of war as a human activity.

III. The *principles of combat command* ("Combat consists of strikes, fire, and maneuvers by units—coordinated in terms of objective, location, and time—to destroy (defeat) the enemy, repel enemy attacks, and accomplish other tasks in a limited area over a short period of time" [27, *p. 8*]):

7) the decisive concentration of efforts on the main direction at the decisive moment;

8) decisiveness, activeness, and continuity in conducting combat;

9) surprise of actions (according to Zhukov, surprise is achieved primarily through two elements, i.e., deception of the enemy and the swiftness of actions [29]);

10) maneuvering with units, strikes, and fire;

11) the protection of armed forces in battle.

IV. The *principles of support*:

12) the timely restoration of units' combat effectiveness;

13) comprehensive combat support.

The US Army Field Manual [28] considers the following **principles of warfare** (similar to those above):

1. *Agility* is the ability to move forces and adjust their dispositions and activities more rapidly than the enemy. Agility requires sound judgment and rapid decision making, often gained by creating and exploiting information advantages.

2. **Convergence** is an outcome created by the concerted employment of capabilities from multiple domains and echelons against combinations of decisive points in any domain to create effects against a system, formation, decision maker, or in a specific geographic area. Convergence is achieved by:

–integration of capabilities at the levels of their most effective use;

– synchronization (organizing combat operations by objectives, in space and time, to maximize the relative combat power at the decisive location and at the decisive moment).

3. *Endurance* is the ability to persevere over time throughout the depth of an operational environment. Endurance reflects the capability to employ combat power anywhere over an extended period under any conditions, including deteriorated communications, chemical, biological, radiological, and nuclear contamination, as well as heavy casualties.

4. *Depth* is the extension of operations in time, space, or purpose to achieve definitive results.

The degree to which a battle or operation conforms to these principles indicates the chance of success.

The laws, regularities, and principles in this section reflect the centuries-long military experience accumulated by the humanity, roughly speaking, by the junction of the 20th and 21st centuries.

The concepts of network-centric warfare and cyber warfare (wars in the cyber domain, including information warfare) of the 1990s, multi-domain hybrid wars and proxy wars of the 21st century, and the rapidly developing technologies of precision-guided weapons, battlefield robots, and artificial intelligence have, unfortunately, not yet been adequately reflected in military science and the corresponding laws and principles. (The experience being accumulated continues to be analyzed and requires further generalization.)

To date, the doctrinal documents and field manuals of the US Army have evolved from network-centric concepts to *multidomain operations* and *multidomain battles*; see [28] and [32].

The US Army Field Manual [28] defines multidomain operations as "the combined arms employment of joint and Army capabilities to create and exploit relative advantages that achieve objectives, defeat enemy forces, and consolidate gains on behalf of joint force commanders. All operations are multidomain operations, regardless of joint force capabilities contributed at each Army echelon." The manual provides a deeper understanding of the current operational environment through three dimensions—physical, information and human—and five physical domains—air, ground, space, cyberspace and maritime. Therefore, the Army employs the capabilities across multiple domains, and the manual requires commanders to understand how the absence of such capabilities affects their operational plans, decision-making, and risk assessment.

5. THE LAWS, REGULARITIES, AND PRINCIPLES OF MILITARY CYBERNETICS

Let us systematize the laws, regularities, and principles of military cybernetics.

We will identify four levels:

I. political: the level of balance between the forces and means of defense and security (on the one part) and the policy (of the state), economics, society, and technology (on the other part, Fig. 4);

II. strategic;

III. operational;

IV. tactical.

There are laws reflecting the dependence of the course and outcome of war (as a means of achieving a state's political goals), as well as of operations and combat, on economic, moral-political, scientific-technological, and military factors.

Further analysis is based on the phases, stages, and steps common to any type of activity [31].

Consider the **general laws of military cybernetics** (Fig. 4). The initial phase of activity (conceptualization) can be viewed as an element of the interconnection between political [33, 34] and military cybernetics.

1. *The law of dependence of the goals and results of armed struggle on the policy and capabilities of the state* (society, economics, science, and technology).

This law specifies the law of purposefulness: each form of control has a goal. It leads to the principles of military development[10], the construction of the state's armed forces and other military units, the principles of their command and control (the principle of hierarchy, the principle of unity of command, the principles of ethics and legality, etc.), and the principles of the use of armed forces.[11] The capabilities of the state, society, economics, and technology determine the quantitative and qualitative composition of armed forces (Fig. 5).

2. *The law of uncertainty*: a true uncertainty[12] arising during tactical-level combat operations (and special operations) and a measurable uncertainty arising at the operational and strategic levels must be addressed using appropriate principles, decision models[13], and command and control mechanisms.[14]

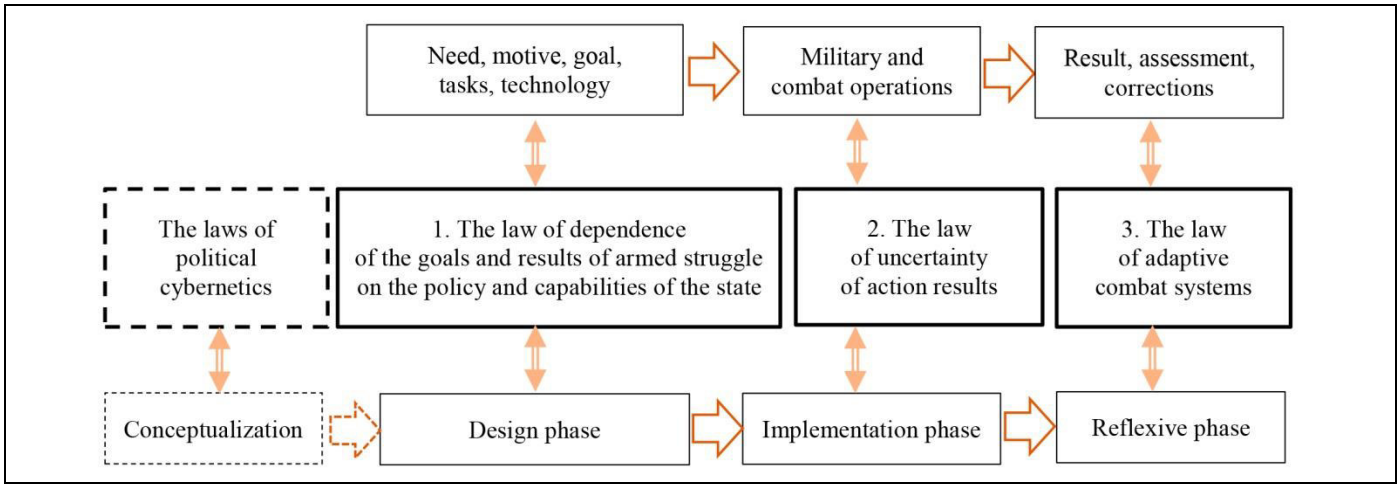

Fig. 4. The structure of activity and the general laws of military cybernetics.

[10] Military development is the set of interrelated economic, sociopolitical, ideological, strictly military, and other measures carried out by the state to create a military organization and ensure its continuous improvement and operation for the state's defense and security. *The Great Russian Encyclopedia*. URL: https://bigenc.ru/c/voennoe-stroitel-stvo-1631b3 (Accessed January 25, 2026; in Russian.)

[11] Military strategy is a an integral part of military art, its highest realm, encompassing the theory and practice of state's military activities to prepare the country and its armed forces to repel aggression, plan and conduct strategic operations and war as a whole, and prevent war. *The Great Russian Encyclopedia*. URL: https://old.bigenc.ru/military_science/text/4168138 (Accessed January 25, 2026; in Russian.)

[12] *Uncertainty* in an *activity* refers to the possibility that certain events may occur during its course that will affect its implementation and result. Note that such events may or may not occur. Due to this uncertainty, it is impossible to predict a priori the characteristics of the activity's result, the time when it will be achieved, and the effort (resources) that will be applied (consumed, respectively) to achieve it [40].
A distinction is made between measurable uncertainty and true uncertainty. *Measurable uncertainty* is defined as the possibility of events described by certain laws. Such events can be analyzed using quantitative methods (e.g., probabilistic/statistical) based on previous measurements or fundamental laws (under the assumption of invariable conditions and regularities). *True uncertainty* refers to the possibility of unique (or rarely recurring) events that cannot be explained by known regularities [40].

[13] Boyd's cycle (Observe–Orient–Decide–Act) is a popular model for decision-making and action under uncertainty.

[14] Management tools include legislative and regulatory acts, plans and orders, instructions, symbols, and markings on maps, etc.

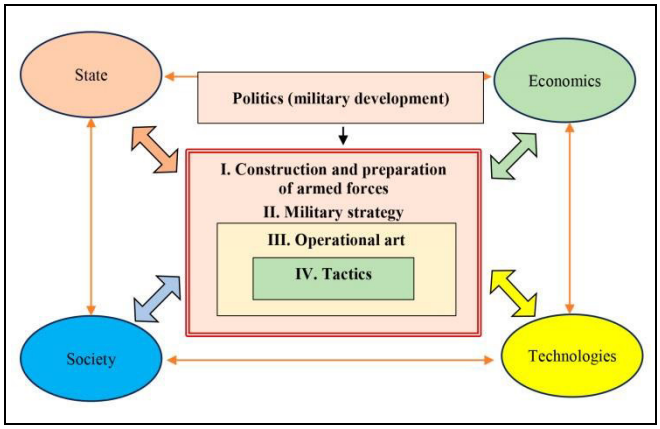

Fig. 5. War and the state, economics, society, and technology.

According to Clausewitz, war is a domain of uncertainty; three-quarters of what military action is based on remains shrouded in the fog of war. His method for eliminating uncertainty is a "fine and penetrating mind." Due to unreliable reports and assumptions, in reality, the combatant faces a situation entirely different from the expected. Many reports received during war contradict each other; false reports are even more numerous, and the vast majority of them are unreliable. Human caution draws on these reports as material for new lies and falsehoods. Another way to eliminate uncertainty at the strategic level is decisive numerical superiority (one and a half to two times) over the enemy in forces and resources, as well as the moral factor [15]; see Beer's third principle of cybernetics in Section 3.

Clausewitz believed that uncertainty decreases when moving from the tactical level to the strategic level. (In other words, true uncertainty becomes measurable.) "In tactics, where the enemy's measures are generally first ascertained by direct sight, and where they may be concealed by every wood, every fold of undulating ground, we must naturally always be alive, more or less, to the possibility of unforeseen events..." [15]. The third method of countering uncertainty is the availability of reserves (their role is particularly significant at the tactical level). Reserves are a means to counter the enemy's unforeseen actions and to rectify the outcome of a battle—which can never be predicted—in the event of an unfavorable turn of events [15].

Based on military statistics of wars and battles in the 19th–20th centuries and theoretical-probabilistic and content approaches, the types of uncertainty depending on the scale and nature of combat operations were substantiated in [35, 36].

3. *The law of adaptive combat systems*: the emergence of new weapon systems (e.g., machine guns and tanks in the past; drones today) leads to changes in organizational structures and tactics, and the development of adequate counteracting means, in terms of performance and cost characteristics [37–39]. The rate of change is assessed, in particular, by the share of casualties from new weapon systems.

To proceed, we assess the connections between the war and military operations-related phenomena (processes) considered in the laws, in terms of their necessity, significance, stability, and repeatability. Note that military and combat activities constitute a "process of continuous project implementation" [31, *p. 38*]. First, the general laws of military cybernetics reflect the main structural components of activity (the top three components in Fig. 4); second, they correspond to the three main phases of a project's life cycle (the bottom three components in Fig. 4).

The above definition of military cybernetics (the science of organizing and managing military, special, and border guard systems) includes two basic categories.

ORGANIZATION is a complex activity aimed at forming the internal order and coordinated interaction of more or less differentiated and autonomous elements of the subject of this activity (particularly by establishing and maintaining interrelationships with specified characteristics among these elements).

MANAGEMENT (CONTROL) is a complex activity ensuring the influence of a control subject on a controlled system (control object) aimed at its behavior that will achieve the goals of the control subject.

The relationship between these categories is shown in Fig. 6, where regulation means decision-making within a specified activity technology, particularly in response to events of uncertainty [40].

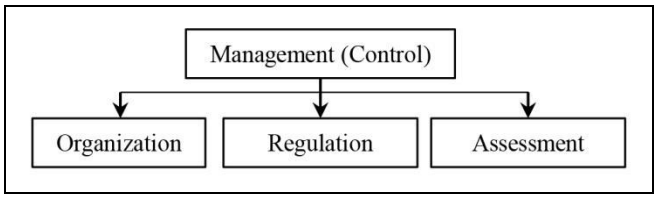

Fig. 6. The general structure of management (control).

Based on this structure, **at all levels—from the development of the armed forces**[15] **to the strategic, operational, and tactical levels—there are partial laws, regularities, and principles reflecting how the course and outcome of war as a whole, as well as operations and battles, depend on the methods and means employed by commanders and military personnel**[16]:

[15] The Organization of Armed Forces. *The Great Russian Encyclopedia*. URL: https://bigenc.ru/c/stroitel-stvo-vooruzhionnykh-sil-86aace (Accessed January 25, 2026; in Russian.)

[16] The letters in parentheses refer to the general laws of cybernetics (Section 3) associated with the partial law or principle under consideration. (In other words, the latter is their special case.)

• ***the laws of organization*** (including planning and support for activities, particularly resources), which ensure:

– consistency of the organizational structure, combat composition, and strength of forces with the goals and tasks of ensuring military security and the defense of the state (C, D, E, and F);

– the capability to adequately increase military power in response to growing military threat (A, B, and D);

– the required balance of combat power between the belligerents (A and F);

– the availability of organizational and technical support (including the number of military personnel, weapon systems, military and special equipment, as well as combat, information, logistical, and other types of support) (B and D);

– the distribution of forces and means in space and time (including their timely concentration on the main direction) (C and F);

– the organization of coordinated interaction at all levels, in terms of goals and resources, in space and time (A and E);

• ***regulation*** (operational command and control, combat command and control), which ensure:

– that military structures remain under the control of the highest state authorities (A and F);

– the adequacy of the capabilities of units and subunits to the tasks assigned to them (B);

– the combat and mobilization readiness of forces at a level commensurate with the military threat (B);

– continuous training of military personnel (D and E);

– full exertion of moral and physical strength (A and D);

– decisiveness, activeness, and continuity in combat operations (A, C, and E);

– surprise (B and D);

– maneuvering by formations, units, and subunits, as well as strikes and fire (C and D);

– comprehensive support for combat operations (C and F);

– protection of armed forces in battle (A and E);

– continuous interaction (A, B, and C);

• ***the laws of assessment***, which ensure:

– accurate assessment of the enemy's and one's own armed forces, means, and capabilities; calculation of forces and means required for combat operations (A, E, and F);

– simplicity of plans, instructions, and orders (A, C, and E).

This set of laws and principles encompasses all those listed in Section 4 and systematizes them.

CONCLUSIONS

This paper has refined the current structure of military cybernetics and briefly reviewed the laws, regularities, and principles of military science. With the foundations and generalizations presented, we have formulated the laws of military cybernetics and classified the principles of preparation and conduct of armed struggle from the perspective of control theory.

Promising lines of further research include the following:

– identifying interrelationships, general laws (regularities), and principles of military and political cybernetics, including the issues of interrelationships and interdependencies between military development, the construction of armed forces, and military strategy;

– specifying the laws (regularities) of military cybernetics and defining their scope of application to special operations, defense, and the protection of state borders;

– analyzing contemporary experience and generalizing it into military science and the corresponding laws and principles of 21st-century military cybernetics (including the concepts of network-centric warfare and cyberwarfare, multidomain hybrid warfare, proxy wars, precision-guided weapon technology, battlefield robots, and artificial intelligence);

– the constructive application of the laws, regularities, and principles of military cybernetics as methodological foundations for modeling armed struggle and combined-arms operations.

Acknowledgments. *The authors are grateful to P.A. Dulnev, O.F. Eskin, and the reviewers for their criticism and valuable remarks.*

REFERENCES

1. Novikov, D.A., *Cybernetics: From Past to Future*, Cham: Springer, 2016.
2. *Modeli voennykh, boevykh i special'nykh deistvii* (Models of Military, Combat and Special Operations), Novikov, D.A., Ed., Moscow: LENAND, 2025. (In Russian.)
3. *Bol'shoi entsiklopedicheskii slovar'* (The Great Encyclopedic Dictionary), Prokhorov, A.M., Ed., Moscow: Sovetskaya Entsiklopediya, 1993. (In Russian.)
4. Leer, G.A., *Opyt kritiko-istoricheskogo issledovaniya zakonov iskusstva vedeniya voiny (polozhitel'naya strategiya). Ch. 1* (Experience of a Critical-Historical Study of the Laws of Military Art (Positive Strategy). Part 1), St. Petersburg: Nikolaev Engineering Academy, 1869. (In Russian.)
5. Wiener, N., *Cybernetics: Or Control and Communication in the Animal and the Machine*, New York: John Wiley & Sons; Paris: Hermann et cie, 1948.
6. Glushkov, V.M., Amosov, N.M., and Artemenko, I.A., *Entsiklopediya kibernetiki* (Encyclopedia of Cybernetics), Vol. 1, Kyiv: Ukrainskaya Sovetskaya Entsiklopediya, 1974. (In Russian.)

7. Sushkov, Yu.N., *Kibernetika v boyu* (Cybernetics in Combat), Moscow: Voenizdat, 1972. (In Russian.)
8. Goldsmith, J., How Cyber Changes the Laws of War, *The European Journal of International Law*, 2013, vol. 24, no. 1, pp. 129–138.
9. *Cyber Defence Handbook*, Washington, DC: Inter American Defense Board, 2020.
10. Makarenko, S.I. and Ivanov, M.S., *Setetsentricheskaya voina – printsipy, tekhnologii, primery i perspektivy* (Network-Centric Warfare: Principles, Technologies, Examples, and Prospects), St. Petersburg: Naukoemkie Tekhnologii, 2018. (In Russian.)
11. Daxhelet, E., Artificial Intelligence and the Future of Warfare, Brussels: Finabel, 2023.
12. *Research Handbook on Warfare and Artificial Intelligence*, Geib, R., Ed., Geneva: UNIDIR, 2024.
13. Chuev, Yu.V., *Issledovanie operatsii v voennom dele* (Operations Research in Military Affairs), Moscow: Voenizdat, 1970. (In Russian.)
14. Venttsel', E.S., *Issledovanie operatsii* (Operations Research), Moscow: Sovetskoe Radio, 1972. (In Russian.)
15. Clausewitz, C., *Vom Kriege*, 1832. (In German.) Translated into English under the title *On War* by Colonel Graham, J.J., London: N. Trübner, 1873.
16. Zakharov, M.V., *General'nyi shtab v predvoennye gody* (The General Staff in the Prewar Years), Moscow: Voenizdat, 1989. (In Russian.)
17. Vorob'ev, I.N. and Kiselev, V.A., The History and Philosophy of Military Science, *Voennaya Mysl'*, 2007, no. 2, pp. 57–68. (In Russian.)
18. Gareev, M.A., *Sovetskaya voennaya nauka* (Soviet Military Science), Moscow: Znanie, 1987. (In Russian.)
19. Zarudnitskii, V.B., Military Science: New Horizons of Knowledge, *Voennaya Mysl'*, 2022, no. 7, pp. 6–15. (In Russian.)
20. Mikryukov, V.Yu., *Voina: nauka i iskusstvo. Kniga 2. Voennaya nauka* (War: Science and Art. Book 2. Military Science), Moscow: RuScience, 2016. (In Russian.)
21. Angstrom, J. and Widen, J., *Contemporary Military Theory. The Dynamics of War*, London: Routledge, 2014.
22. Caliskan, M., The Nature of War and Strategic Theory, *Horizon Insights*, 2021, vol. 4, no. 3, pp. 8–19.
23. Sun Tzu, *Sun Tzu on the Art of War: The Oldest Military Treatise in the World*, translated by Giles, L., London: Luzac & Co, 1910.
24. Golovin, N.N., *Nauka o voine. O sotsiologicheskom izuchenii voiny* (The Science of War. On the Sociological Study of War), Paris: Signal, 1938. (In Russian.)
25. Kapitanets, I.M., *Voina na more. Aktual'nye problemy razvitiya voenno-morskoi nauki* (War at Sea. Current Issues in the Development of Naval Science), Moscow: Vagrius, 2001. (In Russian.)
26. Vorob'ev, I. N., *Taktika – iskusstvo boya* (Tactics – the Art of Combat), Moscow: Combined Arms Academy of the Armed Forces of the Russian Federation, 2002. (In Russian.)
27. Makarov, A.P., Moiseenko, N.P., and Litvinenko, V.I., *Taktika: batal'on, rota, vzvod, otdelenie* (Tactics: Battalion, Company, Platoon, and Squad), Dul'nev, P.A., Ed., Moscow: KNORUS, 2019. (In Russian.)
28. *Field Manual FM 3-0 Operations*, Washington, DC: Department of the Army, 2022.
29. G.K. Zhukov's Speech at a Military and Scientific Conference, December 1945, *Voennaya Mysl'*, 1985, special issue (February), pp. 3, 17–33. (In Russian.)
30. *Osnovy voennoi nauki i voennoi strategii* (Fundamentals of Military Science and Military Strategy), Moscow: Military Academy of the General Staff of the Armed Forces of the Russian Federation, 2003. (In Russian.)
31. Novikov, D.A., *Control Methodology*, New York: Nova Science Publishers, 2013.
32. *Field Manual FM 3-12 Cyberspace Operations and Electromagnetic Warfare*, Washington, DC: Department of the Army, 2021.
33. Deutsch, K.W., *Politische Kybernetik: Modelle und Perspektiven*, Freiburg: Rombach, 1969. (In German.)
34. Yolles, M., The Political Cybernetics of Organisations, *Kybernetes*, 2003, vol. 32, nos. 9–10, pp. 1253–1282.
35. Shumov, V.V., A Study of Contest Success Function for Battles (Combats, Operations), *Control Sciences*, 2020, no. 6, pp. 19–30. (In Russian.)
36. Shumov, V.V., The Victory Function and Its Application in Conflict Modeling, *Control Sciences*, 2026, no. 1, pp. 19–29.
37. Triandafilov, V.K., *Kharakter operatsii sovremennykh armii* (The Nature of Operations of Modern Armies), 3rd ed., Moscow: Voenizdat, 1936. (In Russian.)
38. *Offense and Defense. Army Doctrine Publication ADP 3-90*, Washington, DC: Department of the Army, 2019.
39. Ikonnikov, O.V., Kazakhov, B.D., and Kolyagin, D.A., On the Essence and Content of Adaptive Actions of Organizational and Technical Military Systems in Modern Wars and Armed Conflicts, *Proceedings of the Mozhaisky Military Space Academy*, 2021, no. 677, pp. 286–291. (In Russian.)
40. Belov, M.V. and Novikov, D.A., *Methodology of Complex Activity. Foundations of Understanding and Modeling*, Cham: Springer, 2020.

This paper was recommended for publication by A.O. Kalashnikov, a member of the Editorial Board.

Received February 13, 2026, and revised May 24, 2026. Accepted June 4, 2026.

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Cite this paper

Novikov, D.A. and Shumov, V.V., Laws of Military Cybernetics. *Control Sciences* **4**, 2–11 (2026).

Original Russian Text © Novikov, D.A., Shumov, V.V., 2026, published in *Problemy Upravleniya*, 2026, no. 4, pp. 3–14.

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