INTERNATIONAL SECURITY AND STRATEGY STUDIES
REPORT

Interim Findings on Artificial Intelligence Terms

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Interim Findings on Artificial Intelligence Terms

By CISS Working Group on Artificial Intelligence Glossary Research

I. Weapons (Systems)

1. Weapons

Weapon generally refers to the combat instruments and devices used to attack or defend themselves, which are used to directly kill the enemy's effective forces, destroy the enemy's facilities, or defend against attacks, and can be divided into offensive weapons and defensive weapons.

Weapons and equipment: Weapons and equipment is a general term for weapons, weapon systems and related other military technical equipment used by combatants to carry out and support combat operations. It is an important material basis for conducting war, an important force for generating combat effectiveness of the army, and an important support for completing various military operations[1].

Armaments: Armaments primarily include firearms, artillery, ammunition, tactical missiles, optical instruments (reconnaissance equipment such as binoculars, periscopes, gun sights, anti-aircraft command scopes, etc.), aiming devices, angle-measuring instruments, general-purpose radars, command instruments, mobile power stations, riot control equipment, cold weapons[2], and a range of other weapons and equipment used for military

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[1] *The people's Liberation Army military China,*《中国人民解放军军语》，中国总参谋部、总政治部、总后勤部、总装备部发布，2011.

[2] China Military Encyclopaedia Editorial Committee. (2016). *China Military Encyclopaedia.* Encyclopaedia of China Publishing House.

purposes.

Ammunition: Ammunition refers to items which contain gunpowder, explosives, or other filling materials that can inflict damage on targets or accomplish other tactical tasks. This includes shells, artillery shells, hand grenades, rifle grenades, aerial bombs, rockets, missiles, torpedoes, naval mines, landmines, etc., as well as salutes and ammunition used for non-military purposes such as hunting and shooting sports.[3]

Equipment: Weapons, uniforms, equipment, technical forces, etc. which armies equip with.[4]

2. Weapons system

The Weapons system refers to the orderly combination of several functionally interrelated weapons, technical equipment, etc. collaborates to complete an organic whole of certain combat tasks.[5]

Unacceptable autonomous lethal weapon systems: According to *China's Working Paper on "Lethal Autonomous Weapon Systems",* China believes that "unacceptable" autonomous weapon systems should meet, but not be limited to, the following five basic characteristics:

a. Lethality: Equipped with payloads and means sufficient to cause death.

b. Full autonomy: No human intervention or control during the entire mission process.

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③ China Military Encyclopaedia Editorial Committee. (2016). *China Military Encyclopaedia.* Encyclopaedia of China Publishing House.

④ China Military Encyclopaedia Editorial Committee. (2016). *China Military Encyclopaedia.* Encyclopaedia of China Publishing House.

⑤ Dedi Chen, Zhou Li, and Guisheng Ku, 国防经济大辞典 (National Defense Economy Dictionary), (Beijing: Military Science Press, 2001).

c. Irreversibility: No means to terminate once activated.

d. Indiscriminate killing: Automatically executing lethal tasks regardless of conditions, scenarios, and targets.

e. Evolution: Capable of autonomous learning and functional expansion through interaction with the environment, exceeding human prediction.

"Acceptable" autonomous weapon systems: These have a high degree of autonomy but should always remain under human control, be safely, credibly, reliably, and controllably used, and allow human intervention at any time. In military operations, they must comply with the basic principles of international humanitarian law, including distinction, proportionality, and precaution.[⑥]

3.Non-lethal Weapons

Non-lethal weapons are widely used by the military and other powerful departments in the duty, emergency, anti-terrorism and other tasks, which can disable the target quickly and the disabling consequences have the maximum probability of reversibility under the premise of non-lethal. Non-lethal weapons provide the ability to operate with a minimum of force, controlling violence and preventing unnecessary collateral casualties and destruction.[⑦]

[⑥] 中国关于"致命性自主武器系统"问题的工作文件，2022 年 7 月，https://documents.unoda.org/wp-content/uploads/2022/07/Working-Paper-of-the-Peoples-Republic-of-China-on-Lethal-Autonomous-Weapons-SystemsChinese.pdf

[⑦] 赵陕东，马永忠 . 非致命武器与警用器材 [M]. 北京：兵器工业出版社，2005：45-46.

II. Intelligent/Autonomous Platforms (Systems)

4. Robots

Robots: A machine that automatically performs work. It can accept human commands, run pre-programmed instructions, or operate according to the principles made by artificial intelligence technology. The main tasks of robots are to assist or replace human work, such as in manufacturing, construction, or dangerous tasks. [8]

5. Intelligent weapons

Intelligent weapons: Refer to weapons, weapon systems, and other military technical equipment equipped with advanced technologies such as artificial intelligence (AI), sensors, and automation systems, which provide them with a certain level of autonomous decision-making, target recognition, tracking, and attacking capabilities to implement and support combat actions. These weapons can enhance combat efficiency and accuracy to different degrees in complex battlefield environments, reducing reliance on human operation. The so-called intelligence is an extension and development of human capabilities, as a part of the human-machine interactive environment. Humans, as the primary agents of military and intelligent activities, should retain the necessary capability to intervene when intelligent weapons achieve relatively higher levels of autonomy. [9]

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[8] China National Committee for Terminology in Science and Technology (CNCTST), *Chinese Terms in Computer Science and Technology* (Third Edition), Beijing: Science Press, 2018, p.460.

[9] Compiled based on the basic logic of intelligent weapons, incorporating the views of Chinese scholars over the past 20 years.

6. Autonomous weapons (systems)

In terms of autonomy, the main purpose of autonomy is to reduce the dependence on human and external resources in military operations, to improve the adaptability to complex dynamic environment and survivability on the battlefields, and thus to better accomplish the battlefield missions assigned by human beings. The use of relevant weapons systems should be regulated specifically according to different scenarios and different degrees of autonomous capabilities. If autonomous capabilities are not used in the killing chain (e.g., drones for intelligence collection and reconnaissance), even if some weapons systems have a high degree of autonomy, the autonomy in those weapons will not lead to humanitarian concerns.

The killing chain of weapons systems includes observation, orientation, decision, action and other critical links. Weapons systems with autonomous functions at certain links may not necessarily cause indiscriminate effects. Therefore, general prohibitions or restrictions may undermine the legitimate defense capabilities of countries, and even their rights to use relevant technologies peacefully.

Parities should consider classifying autonomous weapons systems into two categories: unacceptable and acceptable, and prohibit the unacceptable parts and regulate the acceptable parts, so as to ensure relevant weapons systems are secure, reliable, manageable and in line with international humanitarian law and other applicable international law.[10]

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[10] Working Paper of the People's Republic of China on Lethal Autonomous Weapons Systems, 9 August 2022, https://docs-library.unoda.org/Convention_on_Certain_Conventional_Weapons_-_Group_of_Governmental_Experts_(2022)/CCW-GGE.1-2022-WP.6.pdf

——Working Paper of the People's Republic of China on Lethal Autonomous Weapons Systems

7. Intelligent cluster/swarm systems

Artificial intelligence cluster[11]**:** A collection of artificial intelligence (AI) computing functional units that are subject to unified control.

Note 1: The AI computing functional unit may contain AI acceleration processors, AI servers, AI acceleration modules, etc.

Note 2: When composed of AI servers, an AI cluster may be referred to as an AI server cluster, where the AI servers may be referred to as nodes.

Swarm Intelligence[12]**:** Swarm intelligence (SI) is also referred to as collective intelligence (CI)…A group composed of many simple individuals is said to have "swarm intelligence" if its members can accomplish a collective task through simple cooperation…The core of swarm intelligence is that a group of many simple individuals can achieve a more complex function and complete a more complex task through simple cooperation. Swarm intelligence provides the possibility of solving complex distributed problems without centralized control and with limited global information and models.

8. Unmanned system

An **unmanned system** is an electro-mechanical system capable of exerting its power to perform designated missions with no human operator onboard.

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[11] State Administration for Market Regulation (SAMR), *Standardization Administration of China (SAC), Standard of the People's Republic of China: Information Artificial Intelligence Terminology* (GB/T 41867-2022), Released on October 12, 2022 (Effective on May 1, 2023), p.1.

[12] Zhang Guohui & Wen Xiaoyu, *Swarm Intelligence*, Beijing: Tsinghua University Press, 2022, pp.1-3.

The system often equipped with necessary data processors, sensors, automatic control, and communications systems.

9. Unmanned (combat) platform

Unmanned combat platform refers to a type of weapon system to perform combat missions without human operator onboard.

10. Unmanned aerial platforms (drones, unmanned aerial vehicles(UAV), Remotely Piloted Aircraft Systems (RPAS))

Unmanned aerial vehicles (UAVs) are aircraft that do not have an onboard pilot and are equipped with their own power systems.

Remotely piloted aircraft: An unmanned aircraft operated by a remote control station. Remotely piloted aircraft are a subcategory of unmanned aircraft.[13]

11. Unmanned ground platforms

Unmanned ground platforms is an important force in land combat, capable of performing various tasks in high-risk environments without human operator onboard.

12. Unmanned surface vessel

An unmanned surface vessel is a kind of surface vessel that is capable of autonomous navigation and performing relevant tasks by carrying a mission load.

13. Unmanned underwater vehicle

Unmanned underwater vehicle is a vehicle automatically perform its tasks underwater without human onboard.

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[13] Civil Unmanned Aircraft Systems Air Traffic Management Measures, https://jxj. beijing.gov.cn/zwgk/zcwj/bjszc/201911/t20191113_2674230.html

III. Intelligent/Autonomous Technologies

14. Artificial Intelligence

Artificial intelligence refers to theories, methods, technologies and application systems that utilize digital computers or digital computer-controlled machines to simulate, extend and expand human intelligence, perceive the environment, acquire knowledge, and use that knowledge to obtain optimal results.

——*China's White Paper on Artificial Intelligence Standardization (2018)*

15. Machine Learning

It refers to a process that optimizes the parameters of a model through computational techniques to make the model's behaviour reflect data or experience.[14] As a subject, machine learning refers to an inter-discipline that involves statistics, system identification, approximation theory, neural networks, optimization theory, computer science, brain science and many other fields. It studies how computers can simulate or realize human learning behaviours to acquire new knowledge or skills, re-organize existing knowledge structure so that it can continuously improve its own performance, and it is the core of artificial intelligence technology.[15]

16. Deep learning

Deep learning: a method of creating rich hierarchical representation by training neural networks with a large number of hidden layers

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[14] "Information technology - Artificial intelligence - Terminology" (GB/T 41867-2022) issued on May 1, 2023, Chinese Electronics Standardization Institute,https://std.samr.gov.cn/gb/search/gbDetailed?id=71F772D76866D3A7E05397BE0A0AB82A

[15] 中国电子技术标准化研究院 Chinese Electronics Standardization Institute . (2018). *White paper on artificial intelligence standardization,* 人工智能标准化白皮书（2018 版）, http://www.cesi.cn/201801/3545.html

Note: Deep learning is a subset of machine learning.

"Information technology - Artificial intelligence - Terminology" (GB/T 41867-2022) issued on May 1, 2023

Deep learning: Based on learning approaches, machine learning can be divided into traditional machine learning and deep learning. Deep learning is a learning approach for building deep structural models. Typical examples of deep learning algorithms include deep belief networks, convolutional neural networks, restricted Boltzmann machine and recurrent neural networks. Deep learning is also called deep neural networks (referring to neural networks with more than three layers). It is an emerging field in machine learning studies, proposed by Hinton et al. in 2006. Derived from multi-layer neural network, deep learning in essence provides an approach to combining feature representation and learning into one. — ***White Paper on Artificial Intelligence Standardization (2018)***

17. Neural networks

Neural networks: A network of basic processing elements connected by weighted links with adjustable weights, where each cell produces a value by applying a non-linear function to its input values, and transmits this value to other cells or represents it as an output value.

Note 1: While some neural networks aim to simulate the function of neurons in the nervous system, most neural networks are used in artificial intelligence to implement connectivity models. — **National Standard (GB/T 5271.34-2006)**

Neural network: a network consisting of one or more layers of neurons, connected by weighted links with adjusted weights, that receives input data and produces output.

Note 1: Neural network is a prominent example of the connectionist approach.

Note 2: Although the design of neural network was originally inspired by the function of biological neurons, most neural network studies no longer follow this inspiration. — **National Standard (GB/T 41867-2022)**

18. Autonomous control

Autonomous control is the ability to organically combine the sensing ability, decision-making ability, synergistic ability and action ability of the autonomous control system without human intervention, to make self-decision according to certain control strategies in an unstructured environment, and to continuously execute a series of control functions to accomplish predetermined targets.

Automatic control[16]**:** refers to an autonomous operation of machines, equipment, or specific operating states or parameters in production processes enabled by supplementary equipment or devices, according to a predetermined pattern without direct human intervention.

Autonomous control system[17]**:** A system capable of achieving self-stabilization, self-regulation, self-optimization, self-adaptation, and other functions through the integration of computer systems, servo actuators, sensing and feedback mechanisms, stabilization and correction components, digital-to-analog and analog-to-digital conversion, time-sharing sampling channels, and supporting software.

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[16] China National Committee for Terminology in Science and Technology (CNCTST), *Chinese Terms in Computer Science and Technology* (Third Edition), Beijing: Science Press, 2018, p.451.

[17] Wuyi Xiong, Jiafa Zhou, Mingxin Zhuo, Xinguang Li, and Jichang Xu, *Military Dictionary,* First Volume, Beijing: Great Wall Publishing House, p.1041.

19. AI Life cycle

The AI lifecycle refers to the entire process from the concept phase of an AI project to the end of the deployment and maintenance phase. In the *White Paper on Standardization of Artificial Intelligence (2021 edition)*, China cited the definition of AI life cycle system in ISO/IEC 22989 *Artificial Intelligence Concepts and Terminology*, mentioned by Sub-Committee on Artificial Intelligence of the First Joint Technical Committee of the International Organization for Standardization and the International Electrotechnical Organization (ISO/IEC JTC 1 /SC 42):

AI system life cycle model including initial phase, design and development, verification and validation, deployment, operation and monitoring, re-evaluation and exit phases. This life cycle model is derived from the system and software engineering system life cycle and emphasizes the characteristics of the AI field, including development and operation, traceability, transparency and explainability, security and privacy, risk management, governance, etc.[18]

IV. Action and Control

20. Chain of command

In the Chinese context, the term most similar to the command chain is the command relationship. The chain of command or command relationship refers to a continuous line of authority that extends from the top of the command structure to the basic combat unit. usually from the higher level

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[18] *China's Artificial Intelligence Standardization White Paper,* National Artificial Intelligence Standardization General Working Group; Artificial Intelligence Subcommittee of the National Information Technology Standardization Committee,2021 Edition.

to the lower level to form a relationship of command and subordination. According to operational requirements or force formation adjustments, command relationships may be transformed, i.e., the original command relationship is changed and a new command relationship is formed.

21. Command and Control (System)

Command and control: Command and control is an important action throughout military operation. Commanders use orders, planning, instructions, and command and control systems to deploy, coordinate, supervise and restrict troops and operations in order to complete the decided or given operational missions. Joint operation command and control includes monitoring and coordination of various combat activities, as well as regulation and constraints on the exercise of the authority and responsibility of various actors.

Command and Control System: It is a system that guarantees the commanders and command organs to exercise command, control and restrictions on the troops, operations and weapon systems. According to the application level, command and control systems can be categorized into strategic, operational and tactical types.

22. Decision point

A similar concept to the decision point in the Chinese context is decision-making, which refers to the commander received the order from the upper commander, understand the intentions of the upper commander, combined with the judgment of the combat and field situation and made the decision on the actions of his or her troops.

23. Meaningful human control

This is not an official military term; It is a concept developed by scholars in their papers. Our understanding is that autonomous weapon systems

or lethal AI-enabled weapon systems are confirmed by humans at critical mission points, such as target verification, targeting, and before executing a strike, rather than relying exclusively on the prediction or judgment of sensors, autonomous weapon systems, or lethal AI weapon systems.

V. Human-Machine Relationship

24. Human-machine interaction

Human-machine interaction (or human-computer interaction, HCI) refers to the interactive activities between human users and the computer system (a combination of software and hardware units) involving the input and output of information, with the aim of collaboratively achieving tasks that meets human needs. In the context of artificial intelligence technologies, HCI aims to research and design the interactive mode between humans and computer systems, improve the interacitve efficiency of human-machine-environment through smart technologies, and make the communication between humans and computer systems more natural and realistic. Those technologies in the area of HCI include but not limit to natural language processing, speech recognition, gesture recognition, affective computing, virtual reality and augmented reality.

25. Trustworthy AI

A people-centered approach should be upheld in developing AI, with the goal of increasing the wellbeing of humanity and on the premise of ensuring social security and respecting the rights and interests of humanity, ensuring "AI for good" and protecting personal privacy and data security, so that AI always develops in a way that is beneficial to human civilization. To this end, we should continuously improve the transparency, stability, explainability, predictability, fairness and reliability of AI systems,

increase data authenticity and accuracy, ensure that AI technologies can be reviewed, monitored, and traced, and remain AI always under human control.

Transparency: The activities of AI systems such as the decision-making mechanisms, operational processes, data use, and behavioral outcomes can be clearly understood, explained and trusted by humans. This can mainly be reflected in the transparency of algorithms, data and decisions, aiming to achieve the explainability, predictability, traceability, reviewability and accountability in AI technologies. Transparency helps all stakeholders clearly understand how AI systems work, but it shall not be harmful to national interests and the interests of all stakeholders.

Explainability: AI systems are able to reveal their reasoning, decision making, and prediction processes to humans in a clear, understandable, and meaningful manner that enables humans to understand and trust the actions taken or conclusions drawn by those systems. Explainability focuses on providing understandable reasons for the decisions made by AI systems, rather than attempting to argue that "the course of action that was taken was necessarily optimal".

Traceability: The decision datasets, processing and outputs at each stage of the entire lifecycle of the AI systems can be recorded, tracked and traced, so that the decision outcomes of the AI systems can be understood and traced by humans.

Reliability: AI systems are able to consistently and effectively operate in alignment with its intended goals and achieve desired outcomes under various conditions, including both a certain level of resistance to malicious attacks and a fallback mechanism in the event of severe problems.

Predictability: Humans are able to predict and understand the outputs

and behaviors of AI systems under different conditions, enabling them to make reliable assumptions about the expected outputs, which requires the outcomes of AI systems to be accurate, reliable and repeatable, while effectively resisting the vulnerabilities and malicious attacks.

Controllability: Also known as "human control", means human judgment shall be integrated into processes of researching, developing, deploying and employing AI systems, which enables humans to direct, supervise, evaluate, intervene, suspend or terminate the behaviors of AI systems effectively, ensuring that they comply with ethical, legal and safety standards. Additionally, accountability mechanisms for AI shall be established to ensure human as the final subject of responsibility.

26. Chain of Decision

Target identification: Based on the target information provided by various sensors, the AI system determines the target's environment, category and type, as well as the target's friend or foe status.

Target confirmation: The AI system verifies and validates target's identity and status following the target identification to ensure the accuracy and reliability of the identification results, and to confirm that the target is a legitimate object of attack under the laws of war and rules of engagement.

Operation Authorization: The specific operational authority is granted to the AI system based on clear rules, purposes, and restrictions, enabling it to make decisions, take actions, or perform tasks within a defined scope under human supervision and control, ensuring that the tasks are accomplished safely and effectively.

Decision confirmation: A series of processes and mechanisms are employed to review, verify, and validate the decision made by the AI system to confirm its legality, legitimacy, feasibility and potential risks,

which ensure that the decision can achieve the expected outcomes and align with human interests and goals.

Task termination: To end or stop the ongoing task processed by the AI system. Task termination may be caused by various reasons, including the task objective has been achieved, resources are insufficient to continue, the task is blocked in the case of force majeure, or the task itself becomes meaningless and valueless.

Task reset: To restore a task to its initial stage or resets its conditions, objectives, steps and resources, in order to restart the task in a new way or based on new circumstances.

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