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THE FUTURE OF LAND OPERATIONS: COLLABORATION BETWEEN ROBOTS AND HUMAN SOLDIERS

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JCSP 45

Service Paper

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CANADIAN FORCES COLLEGE/COLLÈGE DES FORCES CANADIENNES
JCSP 45/PCEMI 45
15 OCT 2018

DS545 COMPONENT CAPABILITIES

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AND HUMAN SOLDIERS**

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AIM

1. The aim of this paper is to recommend what capabilities the Canadian Armed Forces (CAF) requires for robotics and human soldiers. This information is intended to enhance the perspective of senior officers as they organize the armed forces and its capabilities with respect to the future land operations of Canada. In the light of the situation that I am a member of the Republic of Korea (ROK) armed forces, I have worked on the solutions of the future army based on both CAF and ROK military doctrines and knowledge.

INTRODUCTION

2. The future security environment will be full of high volatility and uncertainty. While the possibility of inter-state war will still exist, the full spectrum of transnational and non-military threats will be more diverse. The trends are leading to a large change in the nature of conflict and war.¹ Enemies will be harder to identify, their attacks will be less conducive to anticipation or deterrence, and they will use asymmetric tactics in confrontation and trigger a high-intensity provocation by using conventional weapons.² So, the future army's need to adapt and change will be conducted in direct competition with adaptive, agile, and lethal enemies.³ It will bring a paradigm shift to re-align the structure of armed forces, overhaul the troop structure in favor of elite personnel, and put in place an advanced, high-technology defense management system. In particular, the future land forces will keep up the essential role in the security of modern states against both regular and irregular threats by expanding the haunting regional and global eyesight and the changing character of war. It is the Army's responsibility to explain why increasing its strength and modernization is core to national security.⁴

3. We stand on the edge of a technological revolution that may fundamentally change thoughts, beliefs, and actions. This revolution is called The Fourth Industrial Revolution (4IR). In the 4IR, revolutionary technologies in various fields, including robotics, artificial intelligence (AI), biotechnology, nanotechnology, and fifth-generation wireless technology (5G), will be developed and universal.⁵ The development of these high-technologies is emerging as a must-have task in the armed forces, and perhaps the application of them is mandatory for us to adapt well to the future operating environment that are summarized by volatility and uncertainty. That is, the technological development of the 4IR will transform the paradigm shift of war, the way we fight. Further, when it comes to the direction of the military reform and the decrease in the number of volunteers to join the military, the command structure will be restructured in the direction of strengthening jointness and preparing for the future operational environment and the

¹ Department of National Defence, B-GL-310-001/AG-001, *Land Operations 2021 Adapted Dispersed Operations-The Force Employment Concept for Canada's Army of Tomorrow*, (Kingston: Directorate of Land Concepts and Design, 2007), 4~5.

² Department of National Defence, A-FD-005-001/AF-001, *the future Security Environment 2008-2030*, (Ottawa: Chief of Force Development, 2009), 5~7.

³ Field, Chris. "Five Challenges for Future Infantry," *Australian Army Journal*, 2009. 33~40.

⁴ Australian Defence Force, *Future Land Warfare Report 2014*, (Canberra: Directorate of Future Land Warfare, 2014), 3~24.

⁵ Schwab, Klaus. "The Fourth Industrial Revolution," *Crown Publishing Group*, 2017.

size of the military will be reduced to transform to an advanced qualitative structure. Of course, the CAF was also preparing for the future based on the concept of the Adaptive Dispersed Operations (ADO) to effectively adapt to the above mentioned issues.⁶ However, although it must be a well-designed the concept, it seems to lack concrete methods that include a little more technological development of the 4IR. So, I will make more specific suggestions for that concept developed in CAF in this paper.

DISCUSSION

The Necessity of Utilizing Unmanned Combat System

4. The aging of the population and lack of enlistment resources of the military are demanding improvement of the military structure with qualitative structure. In addition, the development of the fourth industrial revolution technology such as AI, robots, and Big Data is transforming the battle execution method from the past incentive system to the manned / unmanned mixed combat system based on advanced science and technology. The unmanned combat system in the future battlefield has the advantage of minimizing the loss of troops from the point of view of force protection applications, casualty reduction, and physical or mental cost to personnel. It is possible to be free from the political burden on the people by carrying out the war that the loss of human life is minimized. The unmanned combat system in the future battlefield has the advantage of minimizing the loss of troops from the point of view of human life. For example, in the case of the US military, the explosive device robot was developed in 2001, and 2,000 units were intensively operated while carrying out Iraq stabilization operations. As a result, IED attacks have prevented many casualties since 2008.⁷

5. Second, it can enhance the effectiveness and efficiency of operations by allowing unmanned combat systems to carry out the tasks and functions which were performed by the member of troops. Even in the Dull, Dirty, and Dangerous 3D arena, we can perform battlefield missions in an unmanned combat system. For example, it is possible to minimize the casualties such as the reconnaissance mission in the high-risk area where the enemy response system is established, the mission under the situation where the risk of life should be taken, and the mission of long-term stay operation that requires continuous and repetitive monitoring.

6. Third, it is possible to operate through the unmanned combat system in the area where the operation of the troops is limited and impossible. For example, access to tunneled enemy sites or facilities, increased use of underwater coverage, and ensuring continuous monitoring of specific sites or facilities.

7. Finally, it is possible to create a crucial advantageous phase by using asymmetrically the technology superior to the enemy and to double the flexibility of the battlefield situation recognition and power operation by integrating the manned and the unmanned combat system.

⁶ Department of National Defence, B-GL-310-001/AG-001, *Land Operations 2021 Adapted Dispersed Operations-The Force Employment Concept for Canada's Army of Tomorrow*, (Kingston: Directorate of Land Concepts and Design, 2007), 18~21.

⁷ Republic of Korea, Agency for Defense Development, "the research of the unmanned combat system concept," *ADD journal*, 2015. 22.

The Future Soldier System

8. The continuum of operations is a conceptual framework used to show the relationship between campaigns and the various tactical activities that constitute their conduct.⁸ It can help to understand the complexity of the operation environment. Especially, campaign themes within the continuum of operations can be broadly divided into five categories such as major combat, counter-insurgency, peace support, peace military engagement, and limited intervention.⁹

9. Currently, the Canadian Armed Forces is preparing for a multitude of domestic and international operations. However, more efficient and active combatant capabilities are required in order to prepare for the future operation environment. The future soldier system should be preceded in order to be used efficiently for the unmanned combat system. For example, in the United States, the concept of developing a light infantry-robotic company is evolving and this organization would retain the size and capability of current infantry platoons, while greatly reducing the soldier's combat fatigue, increasing the protection, clarifying the situational awareness, and increasing the firepower.¹⁰ To make this concept a reality, individual soldiers need personal combat platform which applies cutting-edge technology to enhance the individual soldier's combat ability such as sharing real-time information, ensuring a complete viability, and maximizing the combat power. For example, Russian future soldier system can be interfaced with various reconnaissance, control, aiming and target indication devices, including radars, direction finders and unmanned aerial vehicle (UAV) because soldiers have a small receiver and inertial navigation system to provide geolocation data. Also, a helmet-mounted target-indicating system can be developed to provide the capability to shoot.¹¹ In addition, a helmet with bulletproof, communication, surveillance, and peer identification, an intelligent combat uniform with bulletproof, CBR protection, intelligence, hybrid power, camouflage, and detection, and a muscle strengthening system to endure the heavy combat load are required in order to complete the future soldier system.

The Unmanned Ground Vehicle

10. Activities that seek to attack an adversary's cohesion, or to affect the will of the adversary and other targets, are executed through three core dynamic functions such as find, fix, and strike.¹² Even if the future operational environment will change, the three core functions of the operations carried out by the land forces remain unchanged. The unmanned ground vehicles can be used multipurpose such as surveillance, search, close combat, combat transport, and patient transport in terms of the three core functions. Particularly, when combined with the search forces, they contribute greatly to intelligence gathering and reconnaissance missions. If this unmanned ground vehicle is deployed in a unit structure, the reconnaissance missions from the battalion to the corps will be able to quickly and accurately scan the responsible area within a

⁸ Department of National Defence, B-GL-300-001/FP-001, *Land Operations*, (Ottawa: Chief of the Land Staff, 2008), 3-8~3-14.

⁹ *Ibid*, 3-8~3-14.

¹⁰ Morris, Zachary. "Developing a light infantry-robotic company as a system," *Military review in US army*, 2018. 20~23.

¹¹ Fetudinov, Denis. "Russian infantry tests future soldier system," *Jane's Defence Weekly, Journal article*, 2012.

¹² Department of National Defence, B-GL-300-001/FP-001, *Land Operations*, (Ottawa: Chief of the Land Staff, 2008), 4-21.

short time. It can help the commander to provide a basis for correct judgment through real-time information sharing, good situation analysis, and effective BDA evaluation. Further, if we are equipped with Remote Controlled Weapon Station (RCWS) on an unmanned ground vehicle, we will be able to achieve effective fix and strike functions as well as enemy detection. In addition, an unmanned ground vehicle can be used instead of a manned combatant in a dangerous area where the enemy is occupied, so that the life of a combatant can be ensured.

11. In terms of CAF doctrine, adaptive dispersed operations (ADO) are originated in manoeuvre warfare theory and an effects-based approach. The ability to disperse land forces across the battlespace will help the commander to expand his area and allow him to find, fix, and strike accurate targets. Decentralized decision making through common situational awareness will enable the commander to create opportunities and make an effective solution by controlling the tempo of operations.¹³ In other words, the sensor function is most important for the efficient application of the ADO concept emphasized in the Canadian military. The advantages of unmanned ground vehicles, when included in the military structure, are the key to maximizing this sensor function. Therefore, the CAF should invest and focus on the unmanned ground vehicles to realize and power the Family of Future Combat Vehicles (FFCV) concept that integrates a modular family of advanced technology medium and light vehicles.¹⁴

The Combat Dronbot (Drone+Robot) Unit

12. Drones have been popularized and used in a variety of ways from the hobby activities of the general public to the industrial sites. The Republic of Korean Army (ROK) Headquarters established the combat dronbot military research center in connection with the armed forces drones. Reconnaissance drone, self-explode drone, attack drone, and intelligent drone have been extensively studied in terms of portability, speed, efficiency, and stability. The defense reform plan of the ROK army also reflected the creation of the combat dronbot unit for each battalion.¹⁵ In August this year, the ROK army appointed the Colonel as the chief, and formed a troop of the combat dronbot and began full-scale operations. In particular, we can win a war with minimal sacrifice and refer to as an alternative to troop reduction by using the combat dronbots. Further, in the mountainous terrain like Afghanistan which is limited command and control in a battlefield, unmanned systems such as unmanned ground vehicles and combat dronbots will be a crucial factor in winning the ground operation and double the effectiveness of the operation.

13. The combat dronbot can monitor core targets such as war leadership, nuclear or WMD, which are the center of gravity of the enemy and perform strike missions using offensive combat dronbots. This will minimize the damage of friendly forces, defeat the enemy's will, and give the enemy a maximum psychological shock. From a traditional point of view, the combat dronbot may be thought of like a scene from science fiction or movies. But in light of the current technological development, there are enough scenes available that will emerge as the key forces of the army in line with the future working environment. It is clear that the combat dronbots will

¹³ Department of National Defence, B-GL-310-001/AG-001, *Land Operations 2021 Adapted Dispersed Operations-The Force Employment Concept for Canada's Army of Tomorrow*, (Kingston: Directorate of Land Concepts and Design, 2007), 18~22.

¹⁴ *Ibid*, 28~31.

¹⁵ Republic of Korea Army headquarter, "the establishing the Dronbot military research center," *General order 17-508*, 2018.

be a powerful asset in land forces that will actively find, fix, and strike targets in the future operation environment.

CONCLUSION

14. The future operational environment is unpredictable and full of uncertainty. There are various threats and multidimensional challenges that exist in the aspect of the war that we tend to face. To be suitable in the future operation environment the land forces of tomorrow ought to develop and evolve more basically and more quickly than it ever has before.¹⁶ According to changes in the concepts of war performance, reduction of military service resources, and the expansion of life-respect ideology, we need to further study the operations that are appropriate for the future war environment. It is time to take a new approach to combat enemy terror attacks, asymmetric power threats, and war threats at the same time. The technological and scientific development is the most dynamic factor influencing the future operation environment. The technological and scientific development is providing current and future adversaries with ready access to advanced science and technologies as well as the knowledge and expertise needed to take advantage of those science and technologies.¹⁷ Therefore, we need to prepare for the future operating environment through building the most appropriate capability from a long-term perspective.

RECOMMENDATION

15. I think that CAF made up the right concepts and plans which meet the future operation environment. However, no matter how good concepts and theories are, the CAF has to invest, experiment, and act in the robot field with a long-term perspective. The 4IR can provide the enemy forces an opportunity to get the power and skills and then it may threaten the friendly forces through unlimited technological development. On the other hand, it can provide effective and perfect military readiness and superior military power to the friendly forces. We may not have much time. Science and technology are evolving at a speed that exceeds our imagination every day. Rather than blind distrust in technology or excessive short-term interest, a healthy environment needs to be created through steady, sustained and long-term interests and investments in robot fields and future soldier system. If CAF overcomes mistakes and errors in the development process, it will definitely become the core of the future military power.

16. It will be possible to supplement the performance of future combat soldiers, expand the independent role of unmanned combat systems, create the combat dronbot troop to overcome operation environmental limitations, and maximize the combinatorial operation between the unmanned combat system and the future combat soldiers. Finally, I am convinced that the three core functions I mentioned, future soldier systems, unmanned ground vehicles, and the combat dronbot are the bases for us to protect Canada from the future potential threats and to contribute to world peace.

¹⁶ Department of National Defence, B-GL-300-000/AG-001, *Designing Canada's army of tomorrow – a land operations 2021 publication*, (Kingston: Directorate of Land Concepts and Design, 2011), 85~88.

¹⁷ David, Ruth "Avoiding Surprise in an Era of Global Technology Advances," *Committee on Defense Intelligence Agency Technology Forecasts and Reviews*, (Washington DC: The national academies press, 2001).

BIBLIOGRAPHY

- Australia. Defence Force, *Future Land Warfare Report 2014*. Canberra: Directorate of Future Land Warfare, 2014.
- Canada. Department of National Defence, B-GL-300-001/FP-001, *Land Operations*. Ottawa: Chief of the Land Staff, 2008.
- Canada. Department of National Defence, B-GL-310-001/AG-001, *Land Operations 2021 Adapted Dispersed Operations- The Force Employment Concept for Canada's Army of Tomorrow*. Kingston: Directorate of Land Concepts and Design, 2007.
- Canada. Department of National Defence, A-FD-005-001/AF-001, *The Future Security Environment 2008-2030*. Ottawa: Chief of Force Development, 2009.
- Canada. Department of National Defence, B-GL-300-000/AG-001, *Designing Canada's Army Tomorrow- A Land Operations 2021 Publication*, Kingston: Directorate of Land Concepts and Design, 2011.
- David, Ruth. "Avoiding Surprise in an Era of Global Technology Advances," *Committee on Defense Intelligence Agency Technology Forecasts and Reviews*. Washington DC: The national academies press, 2001.
- Field, Chris. "Five Challenges for Future Infantry," *Australian Army Journal*, 2009.
- Fetudinov, Denis. "Russian Infantry Tests Future Soldier System," *Jane's Defence Weekly, Journal Article*, 2012.
- Morris, Zachary. "Developing a light infantry-robotic company as a system," *Military Review in US Army*, 2018.
- Republic of Korea. Agency for Defense Development, "the research of the unmanned combat system concept," *ADD journal*, 2015.
- Republic of Korea. Army Headquater, "The Establishing the Dronbot Military Research Center," *General Order 17-508*, 2018.
- Schwab, Klaus. "The Fourth Industrial Revolution," *Crown Publishing Group*, 2017.