

Robotics and Autonomous Systems for the Armed Forces

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Abstract – This topic aims to study why robotics and autonomous systems (RAS) continued to have an important impact on the history of the armed forces for many decades and could be still widely used by the armed forces around the world [1].

I. INTRODUCTION

The application of RAS in the armed forces is becoming increasingly important to change the nature of warfare [2]. Most of them could go all the way up to the First World War [3]. After the Second World War, the development of science and technology causes important military transformation. Their potentials are becoming the core of the modern armed forces and will permeate every aspect of this field which cannot be replaced now. Its development even will grow exponentially in the near future that it is changing the framework of modern warfare that means it will offer more business opportunities for the public and reduce the budget pressure from the government.

II. CURRENT SITUATION

Every country builds their own international statues by the strength armed forces. There is a huge range of RAS for the armed forces. While current situation mainly has below four aspects.

A. Precision-guided

Guidance of weapons and equipment derives from the Second World War. This is the first time when Germany used the V-1 (in Figure 1) and V-2 missiles to bomb the British Isles [4]. As they lack advanced techniques, those equipment did not excellent performance. While with the development of RAS, the guidance systems made great achievements in accuracy, which reduces the dangerous situation of war. Since the 1980s, direct-hit precision of intercontinental ballistic missile has been improved from 2770 meters (the first generation) to several meters (the 4th generation) [5]. The direct-hit rate is up to 80 percent. As a precision-guided missile could destroy military target that value is more hundreds of thousands of times than itself, the precision-guided techniques are absolute development trends.



Figure 1. V-1 Flying Bomb

Source from: https://en.wikipedia.org/wiki/V-1_flying_bomb

B. Automated

The occurrence of nuclear weapons and precision-guided weapons tremendously increase its destroyed performance, improve the speed of warfare, extend the range and make the process of combat more complex to improve the war efficiency, so that traditional command method cannot control the armed forces. It is necessary to realise RAS from information collection and process to communication and commands [6]. While these requirements must depend on worldwide application of the digital computer. For instance, in US global combatant command system, it spends only 3 to 6 minutes from the top commander to the first-line soldiers step by step. If missing some mid step, the transfer time will be down to 1 to 3 minutes [7]. This is suitable for the requirements in complex warfare situation.

C. Simulated

Other potential field of RAS for the armed forces is that estimate warfare strategy, test the success of campaign plans, and provide training simulation methods based on computer laboratory. It is easier for the well-trained soldiers to understand and complicate relationship between weapons and equipment in a controllable combat simulation, especially when these have detected the opponent armies. Since the 1980s, combat simulation system is one of the available methods as military training for the US armed forces [8]. Using combat simulation not only is an affordable way for training military and improve combat abilities, but also assists commanders to make combat plans with precision evidence and predictable ability, meanwhile save fee and time [9].

D. Scientific

RAS also have an impact on scientific military decisions. The main tasks are that estimate ideas, configure power, make plans, test

global issues and regional stability and so on. By building military databases, module and expects systems, support commanders to make more scientific decisions [10]. There are more efficiency for the protection of border security and territorial integrity. For instance, RAND corporation researched the U.S. Department of Defence who develop and maintain threaten power and practical experience in the peace period. According to strategic target and resource, military could make various plans and calculate different structure indicators for the related decisions [11]. They built database, including weapon systems, threats from enemy and strategies. Due to this result, this corporation advised the U.S. Department of Defence that system analysis becomes the centre to make long-term (more than 15 years) plans for weapons configuration and purchase, shown in Figure 2. What's more, put it into computers in order to deal with variable emergency situation.

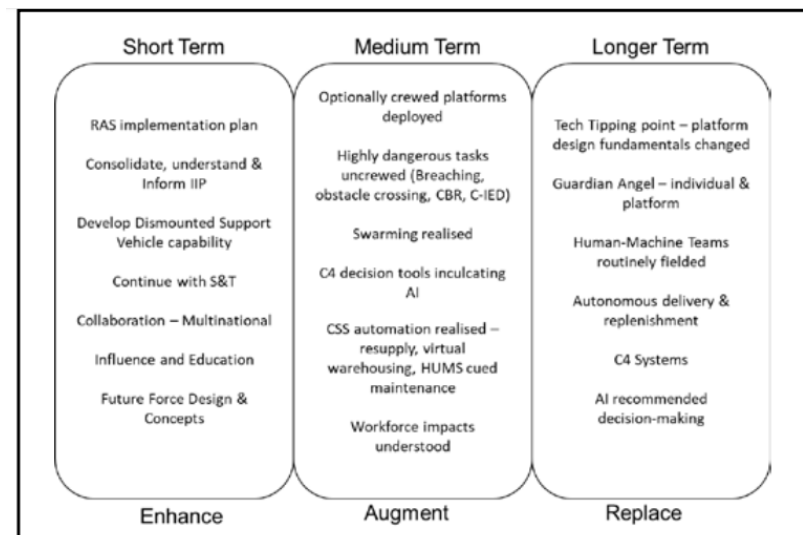


Figure 2. Army RAS Goals [12]

III. Current Imperatives/ obstacles

In order to pursue RAS technologies, the armed forces around the world have to face essential challenges in the future [13]: greater speed of action in warfare, sufficient use of RAS in complex combat environment. To overcome these challenges, the armed forces catch the development opportunity of robotics and autonomous systems.

IV. BUSINESS OPPORTUNITY

The money is pouring in RAS for the armed forces, the support of government must be taken into consideration. However, most companies found their prospects as it is hard for the government to face heavy budget pressure and master every aspect of techniques. By using these advanced techniques, these companies capture huge market and obtain more profit. The long-term government monopoly is being replaced by high-tech companies. For instance, RAND corporation aims to provide research and information analysis services for the armed forces at the beginning time [14] [15]. As these 'privatization' occurs, there are increasing business opportunities for some companies which have excellent or unique techniques to cooperate with the armed forces.

V. DISCUSSION AND CONCLUSION

There is no replacement for RAS for the armed forces. With the development of RAS, which always plays a crucial role, its applications are used by most of the modern armed forces as one of the most important parts of the modern armed forces technologies and will be used to every aspect in the future. These trends are profoundly changing the pattern of modern warfare in armed forces. What's more, its development also offers more business

opportunities for some companies which have advanced technologies and release the budget pressure of the government.

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