SUSPENSION DESIGN OF AN UNMANNED AUTOMATIC GUN SHOT SYSTEM PLACED ON A VEHICLE

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SUSPENSION DESIGN OF AN UNMANNED AUTOMATIC GUN SHOT SYSTEM PLACED ON A VEHICLE

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ABSTRACT

SUSPENSION DESIGN OF AN UNMANNED AUTOMATIC GUN SHOT SYSTEM PLACED ON A VEHICLE

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The thesis work is divided into five sections as the main sections. Underneath the frontier of unmanned maneuver are the implications and consequences of manless disruption in daily life, the value and consequences of military landlessness, the contributions of unmanned systems, the weaknesses of unmanned systems, and the moral dimension of the use of unmanned systems. The historical dimension of the military field unmanned disaster, the definition of unmanned systems and the types and characteristics of unmanned systems from the classroom, unmanned systems and autonomy. Since the modern era, the progression of the infantry class and the development of informatical developments in the war, the infantry class is being explored according to the use cases in the historical wars. Under the heading of reorganization of the infantry class in line with the latest technological advances, planning, concept, staff, tools, weapons, equipment. In the following section; unmanned vehicles in Turkey, parameters, mounting of a specified weapon system. In this study, modeling was done in Solidworks, and then our dynamic analysis was carried out in the ANSYS program, we saw with the program that how much repulsive force was exposed on the system. At the same time, a mechanical simulation was applied to make the suspension selection in Matlab software.

Key words: Unmanned weapons, Weapons, Unmanned vehicle

ÖZ

İNSANSIZ SİLAH ATIŞ SİSTEMİNİN TASARIM VE ANALİZİ

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Tez çalışması ana bölümler olarak, beş kısımdan meydana gelmektedir. İnsansızlaşmanın önemi başlığının altındaki kısımda günlük hayatta insansızlaşmanın önemi ve sonuçları, askeri sahada insansızlaşmanın değeri ve katkıları dahası sonuçları, insansız sistemlerin üstünlük ve buna karşın zayıf olduğu noktalar ve insansız sistemlerin kullanılmasının ahlaki boyutu konuları irdelenmektedir. Askeri sahada insansızlaşma topiği altındaki kısımda, askeri alanda insansızlaşmanın tarihsel boyutu, insansız sistemlerin tanımlanması ve tasnifi, insansız sistemler ve otonomi, hava, kara, deniz ve uzay araçları sınıflarından meydana gelmiş insansız sistemlerin türleri yapıları ve özellikleri; Türkiye'nin sahip olduğu insansız araçlar konuları incelenmiştir. Modern çağdan beri piyade sınıfının ilerlemesi ve savaşlardaki enformatik gelişmeler topiği altındaki bölümde, piyade sınıfının tarihi savaşlardaki kullanılma durumlarına göre irdelemesi yapılmaktadır. En yeni teknolojik ilerlemeler doğrultusunda piyade sınıfının yeni baştan teşkilatlanması başlığı altındaki bölümde planlama, konsept, kadro, araç, silah, teçhizat, enerji gereksinimi ve eğitim alt başlıkları incelenmektedir. Daha sonraki bölümde ise; Türkiye'nin sahip olduğu insansız araçlar, silah yerleştirilebilen araçlar, parametreler, belirlenen bir silah sisteminin monte edilmesi, taşıtın dinamik olarak modellenmesi, süspansiyon seçimi ve süspansiyon tasarımı yapılarak sonuç ve öneriler irdelenmiştir. Bu çalışmada modelleme Solidworks'de yapıldıktan sonra ANSYS programında dinamik analizimiz yapılmış ve geri tepmeli silah tasarımının ne kadarlık bir kuvvete maruz

kaldığı ortaya konulmuştur. Aynı zamanda Matlab yazılımında süspansiyon seçiminin yapılması maksadıyla mekanik simülasyon uygulanmıştır.

Anahtar Kelimeler: İnsansız silahlar, Silahlar, İnsansız araçlar.

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LIST OF ABBREVIATIONS

ABD	United States of America
AFRL	Air Force Research Laboratory
ALFUS	Autonomy Levels for Unmanned Systems
ARDEC	Armament Research Development and Engineering Center
AR-GE	Research & Development
ARL	Army Research Laboratory (Land Forces Research Laboratory)
BH	Buffalo Hunter
BOM	Computer Game Center
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance

CHAPTER 1

INTRODUCTION

The industrialization process, which started with the use of steam power in the 1800's, brought with it the mechanization process. Machines that operate with human control have provided great convenience to many people in the field. In the civilian sector, the machines used in the military field are gradually becoming widespread when they enter the 20th century.

The computer technology that started to be used in space studies in the 1960s deeply affected the mechanization process and the machines and computers started to be used in a system that complement each other.

According to Moore's Law, processor technology will have access to almost the capacity of the human brain in the 2030s. When evaluated in this respect, today only computers that can perform the given commands will be replaced by computers that can be learned and applied in the future. The physical size of the processors and the increase in their capacities have made it possible for even the simplest weapon system to have intelligent technology.

However, the fact that wars are increasingly being carried out in cities, the complexity of their duties and the inability of the public authorities of the country to tolerate human casualties have led the states to unmanned military territory.

Short-range, simple unmanned systems or model air planes managed by wire during World War I were not included in the calculations, and II. It can be argued that the V-1 focused by the German army during World War II and directed by radio frequency took it space as the first unmanned vehicle in the literature of disinfection.

Along with the use of global positioning system (GPS) in the following years, the first unmanned aerial vehicles for exploration started o be used in the 1991 Iraq War. Unmanned vehicles change course of wars is a situation that emerged in

Afghanistan and 2003 Iraq wars. The fact that laser-guided bombs can hit target switch accuracy up to five meters, increased volume, the ability and also efficiency, and to visualize satellite technology with in a short delay of one second have encouraged the use of them, especially in America.

Countries that are able to complete the triangle of satellite, GPS and laser-guided bombs by their own means are considered to be the pioneers of military field unmannalization. In this context, the United States, the United States, Russia, China, France, and the United Kingdom, are the undisputed supremacy of the United States on military deterrents from countries that have a say in the world and are five permanent members of the United Nations. The fact that France has a sufficient but unprecedented technology, the dependence of British technology on the United States, the reverse engineering of China and Russia, and the efforts to place it in this impersonalization brings the United States to the forefront of this issue. The share that the US allocates to research and develop (AR-GE) from the budget for disarmament is a size that will not be accepted by other governments, as mentioned in the next sections. For these reasons, a US-focused study has been conducted on this study.

Unmanned and technological developments are deeply affecting the infantry class, the oldest military class in history. The complexity of the battlefield and the shift of wars to cities no longer shrinks the infantry class; forces other military classes, such as artillery and tankers, to join the organization of the infantry class.

The tanks of the tank class have the potential to fight in narrow and irregular city streets and to set a major target for manned or unmanned air / land vehicles carrying laser-guided bombs, following the use of machine guns, the cavalry units are likely to live in a tank class similar to the process of withdrawal from battlefields.

In the same way, gunners who use ammunition with large diameters also suffer casualties in city wars and also make it easy to target like a tank; leading to the loss of the old charm of the artillery. Infantry class; to the tank class by the fact that the wheeled vehicles that they possess can be effectively used in the residential area by being able to attract themselves to the safe area even when the tires are blown and can be mounted on vehicles of hypersonic vehicles; intelligent towed mortars and mortar munitions have also taken over the superiority of the artillery class.

Furthermore, the introduction of unmanned air and land vehicles to the use of the infantry class indicates that infantry will be in the future in the presence of military classes.

There are two basic doctrines in the military literature in the world. The first is the quantitative doctrine of human power, created by the countries of Russia, China and the former Eastern Bloc, and the other is the technology-based qualitative doctrine created by the NATO nations in the US pioneer. It is clear that the basic doctrine that will shape the battlefield in the future will be a technology-centered doctrine. As a result of these reasons, a study of the infantry class was carried out in the USA as a whole.

While this graduate study was being prepared, there were not many examples that could be benefited from the thesis pool or other studies in Turkey in the course of resource search. Scientific reports published by working scientists in the United States have been used among these sources, while generally used from US sources. The National Academies Press, which has recommendations for decision makers in the field of science, engineering and medicine, has formed the backbone of this work.

In the 30 years of state strategy of the USA, the issue of disinfection, which has not yet been understood much in Turkey and Europe, has been fully planned including AR-GE and necessary studies have been carried out. The struggle of the military for the destruction of the military sector, which started with the direct purchase of Turkey, is proceeding only in the unmanned aerial vehicles lane.

However, "Unmanned Aerial Vehicle Systems Roadmap 2011-2030" published by the Undersecretariat for Defense Industries covering the years 2011-2030 can be said to be a great development for Turkey in terms of sustainable disaster. From this point of view, this postgraduate study is a pioneering work in this area across Turkey, as well as a source for future work on these and similar topics. It is also important to study the military field in such a way that it is incomplete about unmanned operation.

For this reason, the aim of this study is to investigate how to make unmanned weapons and unmanned weapons in the military area in the light of new technological developments.

CHAPTER 2

UNMANNED

2.1 The Importance of Being Unmanned

When human history is examined, it can be assumed that the unmannalization began with the Industrial Revolution in the 1800s. When the workforce at the industrial facilities took the place of mechanization, it was met with the need for equipment in some business lines.

The machines were an intermediate element, in that they did not do any work on their own, but were entered into the system by the human hand and guided by these tools. Approximately one and a half centuries after the Industrial Revolution, machines that can perform tasks assigned within certain boundaries have begun to emerge. These machines, which are more independent and task-oriented, have been accepted as the realm of unmannalization in the real sense.

Along with the use of computer and processor technology together with the machines, these machines have also been given the title of "unmanned". For example, a dozer used in construction is a machine. However, when a computer is installed in this volume and is programmed to do what is to be done, it is turned into a "unmanned dozer" instead of a dozer machine. In this section, the unbelief to be investigated is separated from mechanization in this respect.

Another term synonymous with the term of unmannisation is robotization. The robot term was first used in 1921 by Czech writer Karel Capek to indicate workers in Rossum's Universal Robot's book. In 1941, Isaac Asimov's story entitled Robotics, the robot industry's rise, and the book Runaround, which he wrote a year later and described the three laws of robots, brought the term robot to its current meaning.

The three robot laws expressed by Asimov, who are trying to define the robots by law (Reddiar, 2011);

Robots should protect people, robots should keep people safe, robots should follow commands given by people.

Revised robot laws are; The robot should not harm people, the robot must obey people's commands, a robot should not harm another robot.

In recent years, computer, communication and electronic systems and computer integrated machines have led to the development of robotic systems and have reduced the production costs of robots. This transformation in the robotic systems has shown itself in the consumer market, the education system, the business world, and the military field (Tsourveloudis et al., 2005). Some of the programs shown in Figure 1 are used in the robotics industry, which is distinguished by the comparison between sensors and software. The Robot C program was developed by Carnigie Mellon University Robot Academy in USA using the "C" program for robots, the last generation robot program that adapts itself according to the changing situation by constantly updating the data received from the sensor (Reddiar, 2011).

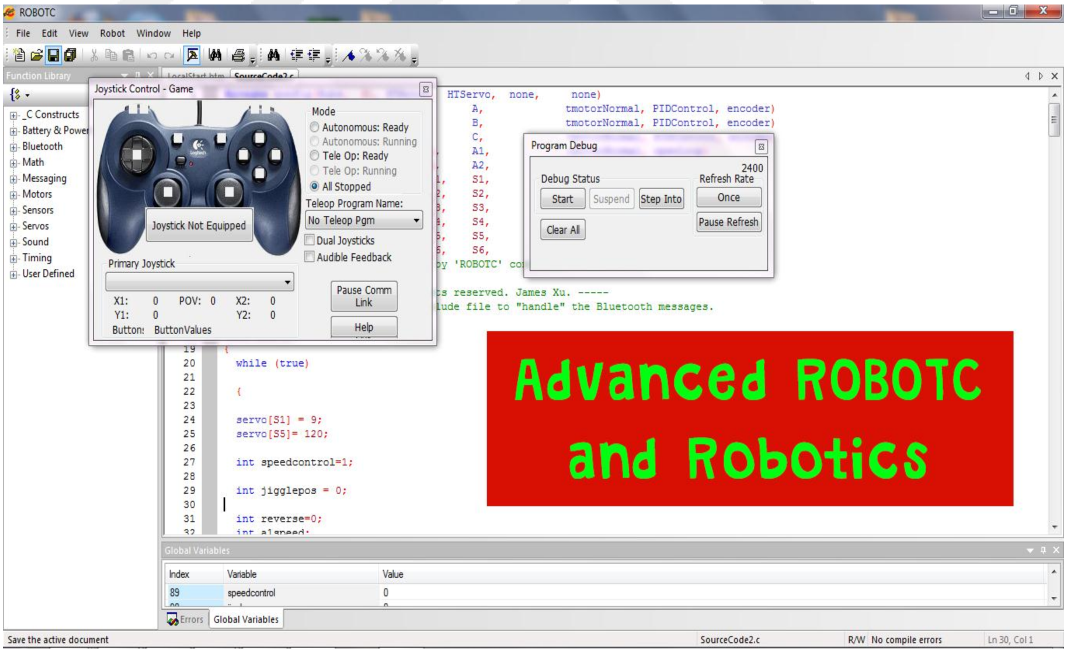

Figure 1 ROBOT C software for programming robotic systems (Tsourveloudis et al., 2005)

The number of robots in the world is increasing day by day and the price is falling in reverse proportion. The robot price in 2006 is 80% cheaper than in the 1990s.

Nowadays it is almost possible to make an unmanned aerial vehicle (IHA) with about 1000 TL (Quintana, 2008).

Robots in the A Robot In Every Home, written by Bill Gates, a well-known Microsoft businessman in 2006, find it difficult for humans to see or challenge in the future; They will be widely used in occupations or business areas such as military service, construction and surgery. Gates stated that no one should ever underestimate the likelihood of a robot in every home in the future, as long as anyone says 30 years ago that it will be a computer in every house.

Non-civilian uses of unmanned systems include: atmospheric and geographic surveys, mineral exploration, police surveillance, border security, security of energy lines, traffic safety, disaster surveillance, cartography, search and rescue, agricultural disinfection, fire surveillance and so on. The potential use of unmanned aerial vehicles shown in Table 2 in civilian and industrial areas is divided into six categories (Wallace, 2012). The potential uses of IDA in the civilian arena include:

1. Security services; murder scene investigation, crowd control, search-rescue and education services.

2. Fire and emergency services; fire extinguishing, fire surveillance, surveillance against arson and training services.

3. Energy sector and network services; protection of energy infrastructure such as oil and natural gas, and monitoring of transportation networks such as railroad nets.

4. Use in agriculture, forestry and fisheries; natural environment monitoring, agricultural medication and insemination services.

5. World observations and early warning services; seasonal inspections, field photography, observation of seismic events, and early warning of natural disasters such as tsunami.

6. Communication and publishing category; The use of IDAs as satellite substitutes involves the provision of short-range local connectivity and use as a camera platform. As a result, even though it does not reflect much on the press, it can be said that the DRDs take on many tasks in civil life and become increasingly widespread.

Figure 2 Potential utilization of CPIs in civil and industrial areas (Wallace, 2012)

Figure 3 shows an unmanned agricultural vehicle operating in the agricultural sector while Figure 4 shows the components of the unmanned agricultural vehicle consisting of GPS system, compass, gyro, laser sensor, temperature sensor, RPM and fuel tank (Moore, 2008).

The use of unmanned farming tools that have been field-scanned with sensors has also become widespread (Jones, 2009). Unmanned agricultural tools are a form of unbelief in the future.

It can be easily predicted that the human factor will lose its importance in the future in all agricultural activities from irrigation of agricultural machinery to seeding process to irrigation and crop harvesting process.

Figure 3 Autonomous unmanned agricultural vehicle in agriculture sector (Moore, 2008)

Figure 4 Unmanned agricultural vehicle (Jones, 2009)

In France, a farmer began to feed the cows in the barn using robots. A farmer named Jean Pierre Defau, who lives in Erbree, to the west of the country, established feeding automation for 140,000 euros (Web 10). Figure 4 shows the robot feeding system set up by the farmer. It can be easily expressed that this feeding system allows the French farm laborer to save time and time.

Figure 5 Robotic feeding system established by French farmers (Web 10)

Another area of robot use is the medical sector. with a remote doctor-controlled robotic surgical system, surgical intervention with a delay of one percent of that in a completely sterile environment will be possible (Chiang and Wrightson, 2012). It will also show when the robots or the doctors are the millimetric surgical intervention, and whether people will trust the robots.

Robots are also used for the care of the elderly. For example, the government of Japan has allocated 100 million USD AR-GE budget to Kyoto University in 2009 for the development of personal robots for the care of the elderly (DEPS, 2010).

Reaper model DRAs, certified by the US Federal Aviation Administration, have taken on important roles in search and screening activities in the Katrina Hurricane (Archontakis, 2010).

As a result of the earthquake that broke out in Japan in March 2011, tsunami occurred and some nuclear reactors belonging to Japan were damaged. For the determination of this damage occurring in reactors 1, 3 and 4, UAE was used. Figure 6 shows the image of the disaster in Fukuyama sent to the center (Snyder, 2011). Such a risky task can also be done with human helicopters or aircraft, as in the Chernobyl accident in 1986. But due to the radiation effect, it is highly probable that pilots' lives will be in danger. As it is clear from this example, the JHA has successfully completed many dangerous tasks.

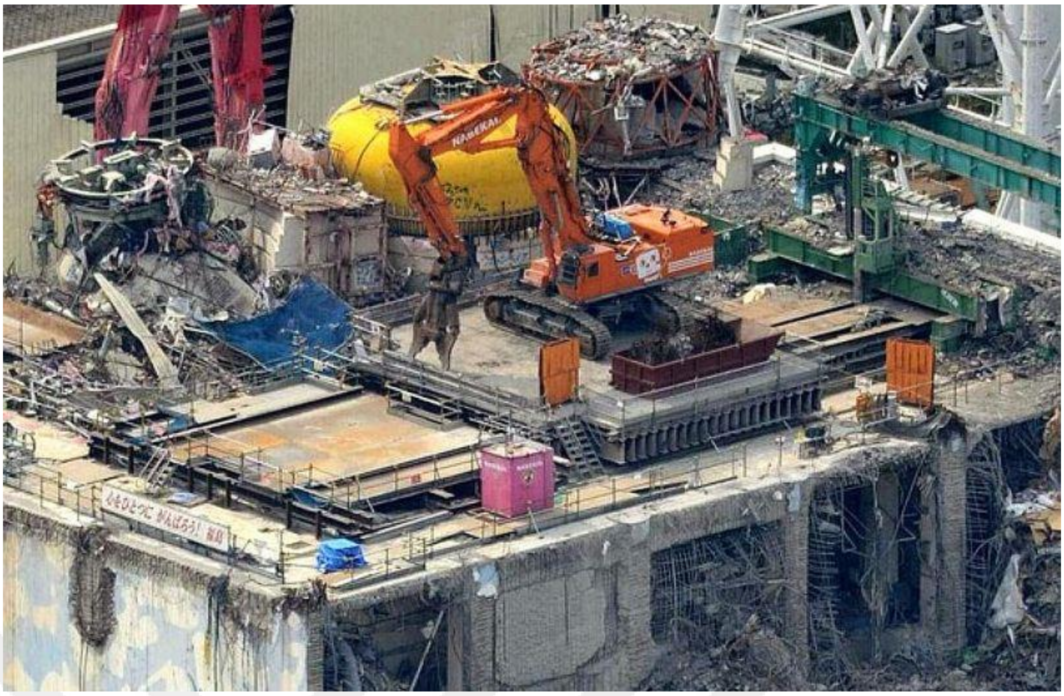

Figure 6 An image of the scene from the RQ- 16 T-Hawk RPR, showing the images of the explosion at Fukuyama 4 Reactor (Archontakis, 2010)

The use of small DRDs for wildlife observation has become increasingly accepted (Lee, 2004). In Tampa Bay and Florida, animals in natural habitats can be observed through RHA, so that their natural life can be detected at the time of an unnatural intervention.

Until 2030, according to the US Department of Defense, most of the war, cargo and transport aircraft will have unmanned systems (Bessemer, 2006). In addition, efforts to make unmanned commercial cargo aircraft are continuing rapidly. When unmanned, the training and employment costs of pilots can come from being a burden on companies. FEDEX, a world famous cargo company based in the USA, is a cargo company that has set its vision to use unmanned cargo flights. In a speech by FEDEX CEO Fred SMITH; "We must first establish an unmanned cargo flight file ..." (Neal, 2010).

According to industrial estimates, the WWP tasks will be spread in various fields and presented to the civilian and military sectors. Approximately 50 US companies, universities and government organizations have developed 150 different models of RTA. According to estimates from 2010-2019, it is estimated that a total of 35,000 JHA will be produced (JPDO, 2012), 20,000 of which are within the US.

The areas of use of IDPs within US borders are as follows:

1. Border security services: The US Department of the Border and Customs uses a variety of DRAs for border protection and surveillance. In addition to their use in

relation to external security, they have also found widespread use in border security related to internal security. The purposes of use of IDHA in border security services; (TSPO, 2006), preventing illegal entry (refugees), preventing the introduction of drugs and derivatives into the country, and securing border security for 24 hours (TSPO, 2006).

As a matter of fact, the US and the DRCs in the states of Texas and Arizona, which are located on the Mexican border, have begun to be used to prevent trafficking and drug trafficking. The US Department of the Interior has assigned 3 Predator models to the Mexican border, 2 to the Canadian border, and 1 to the Caribbean, 20 tonnes of drugs and 7,000 migrants have been arrested by 2010 (Snyder, 2011).

2. Use of internal security units: Police and Federal Bureau of Investigation (FBI) have begun to use small class DRAs. Usage areas in this category are;

fighting crime, traffic situation detection and search and rescue activities. Figure 7 shows a mini UAV used by the French Police (Wallace, 2012).

Figure 7 When using French Police (Wallace, 2012).

The Los Angeles Police Department also created a runway near Los Angeles Airport to use unmanned aerial vehicles. Apart from that, 3.5 kg with 2 hour flight time. it is anticipated that the use of class-1 unmanned aerial vehicles with weight in police patrol duty will become widespread (DeGarmo and Nelson, 2004).

3. Protection of critical infrastructures:

a. Crisis desk: In order to monitor and report any natural catastrophe, IDPs are assigned to be used by the US government authorities for the crisis.

b. Observation of forests: Forests are the national values of countries. In 2009, the US Forest Service purchased three Predator models for the monitoring of forests. The fire near Palm Springs, California in 2009, could be watched through the DRAF. In addition, the US Forest Service also requested the government to purchase unmanned fire fighting helicopters.

c. Use of the Ministry of Transport: The Ministry of Transport has purchased a certain number of MRAs for monitoring highways, sea roots and rail systems.

d. Usage in the field of agriculture: It is predicted that the use of RPE will be widespread for use in agricultural medicine.

e. Energy security: Critical energy, oil and natural gas pipelines are expected to be monitored by RTAs in the near future (Darnell, 2011).

The US National Aeronautics and Space Administration (NASA), the Ministry of Defense, the Air Force, and the Ministry of the Interior are working jointly to establish rules and laws on how unmanned systems should use air corridors (JPDO, 2012).

DARPA, the US Department of Defense's AR-GE organization, is organizing a competition every year since 2005, in which unmanned vehicle projects are racing. A photograph of 2007 is shown in figure 8 (Sklar, 2010).

Figure 8 Autonomous Vw Passat brand vehicle, second in DARPA's 2007 robotic behicle competition (Sklar, 2010).

Andy Rubin, former CEO of Google Android, explained that the company's new goal is to develop robots. Google has released a number of robotic-based companies that Rubin buys for robot projects. Google has also incorporated the Boston Dynamics company, which is known for its military robots it produces for the Pentagon, and has thus acquired the eighth robot company. The company's new CEO, Schmidt, claimed that the mobile revolution would overturn dictators by 5-10 years (Web 8).

As a result, although the effect of unmannalization is hardly felt in everyday life, the prospect is really great. Unbreakable technology that grows up quickly and steadily will probably be a feature that will make people feel right next to each other, perhaps in the future. In many areas of life from agricultural to medicine, from safety to transport, robots will come to be the people's co-workers.

2.2 The Importance and Effects of Unmanned Daily Life

Since the beginning of history, mankind has always fought and established ordinances for this. Scientific research, which is supposed to make life easier, is often used to develop military technologies, and states that want to reduce the cost of production of a weapon or system have directed a part of the related military technology to the civilian sector. Unmanned as it is in other areas, the military field has begun to develop.

The invention and use of robots is one of the greatest revolutions that have arisen on the battlefield since the invention of the gunpowder. In addition, the use of robots is seen as a threshold in terms of the history of war according to some (ARLTAB, 2011). The robots used in 2001 Afghanistan and 2003 Iraq wars are creating a revolution in terms of war history. It is not wrong to foresee that future battles will pass between different robots in terms of size, design, ability and autonomy (Larkin, 2011).

The states have begun to understand the importance of robots in military affairs. In the conclusion of a report published by the US Air Force's AR-GE unit SAB in 1996, it was alleged that the most basic way of protecting the US super-military superpower was to develop unmanned systems. This conclusion, which was also shared with the Congress, has created a milieu for the United States in terms of some of the creation of new concepts (Glade, 2000).

Bessemer explains how important the robots are in winning or losing battles: "Consider an army with the world's most advanced weapon systems and ammunition, think of another army of robots, robots, air and sea, with ten thousand robots, 80 probably a human army will win, but the 500 thousand people you will give to your casualties, the enemy does not lose any people, does it mean that you win the war? " (Bessemer, 2006).

Interest in unmanned vehicles in the armed forces is increasing worldwide. Nearly a year the country has bought an unmanned aerial vehicle, some of which have begun to produce. No country has yet reached the success of the US on the subject of unmanned vehicles.

Although the People's Republic of China has exhibited at least two dozen unmanned vehicles at the Zhuhai Air Show in 2010, their competence has not yet been proven (Guest, 2011). In addition, in 2001 Afghanistan and 2003 Iraq operations, the US army found unmanned combat machines on the battlefield and tried to adhere to it technically and tactically. But Russia, China or the European states have not had such an opportunity.

Turkey, on the other hand, has used Heron model SRAs from Israel for discovery and target marking purposes only. However, unmanned aerial vehicles, such as Anka, which can be mounted with weapons produced by themselves and new models, have not yet been found on the battlefield.

2.3 Importance of unmannalization in military area

Army commanders want to see robots in arms inventory and use them on the battlefield. Because they are both cost-effective and do not have any risks in the battlefield. According to a preview of the US Land Forces AR-GE lab; it is estimated that by 2020, the US army will reach a significant level of cooperation with industry, universities and military related to the use of robots (ARLTAB, 2011).

The US is planning to use robots completely in wars during the next period. According to a study conducted by the US Congress, it is planned that critical attack aircraft will be launched from 2010 and that one third of the land vehicles will be unmanned by 2015 (Reddiar, 2011). According to Larkin, it is planned that by 2015 one third of combat land and air vehicles will be unmanned (Larkin, 2011). The extent to which this goal has been achieved is not yet known.

The 2003 Iraq Operation and the ongoing Afghanistan Operation have used approximately 8,000 unmanned land vehicles and a total of 125,000 missions.Tasks mostly consist of identifying suspect objects, route verification, and the identification and destruction of hand-made explosives (DoD, 2010).

Unmanned vehicles are simply designed to be used in three types of military missions (Neal, 2010):

1. Dangerous duties: Duties that human life can take to a great degree of danger. Reconnaissance operations in Iraq and Afghanistan are examples of these tasks.

2. Dull tasks: Tasks that require a long period of discovery and surveillance, and that will be delivered after a certain period of time if the person does. Border security tasks are examples of these tasks.

3. Dirty tasks: It is very difficult and dangerous for people to be able to detect in areas contaminated with nuclear, chemical or biological weapons. Such tasks are called dirty tasks. The discovery of battlefields and nuclear facilities contaminated with nuclear, chemical, or biological weapons can be given as an example.

In areas where unmanned vehicles are not communicating with existing communication devices other than the above mentioned tasks, the ability to provide communication and communication is planned to be used (NSB, 2004). Unmanned land vehicles (IKA) are likely to reach the ability to conduct identity checks at military control points in the 2020s. When this practice is passed on, the suspects who escape from the control of the ICAs will be able to be followed and operated through the DRAs (Wallace, 2012). With unmanned systems, material transfer from one place to another may also be possible. For example, medical devices and medicines can be sent to the battlefield with mini helicopter DRAs (Kaya, 2010).

Some countries outside the United States also attach special importance to the military field unmanned. Especially Israel and South Korea are working hard on this issue. Israel's robotic "see-shoot" system is bordered by the Gaza border, while the South Korean "Samsung SGR-A1" system is autonomously bordered by the North Korean border, with similar measures in border lines planned for China, India and Russia (Quintana, Turkey can take similar measures for the Syrian border, which has a relatively flat character compared to other borders, which requires investing in unmanned land vehicles.

On April 20, 2003, Matthew Brzezinski claimed in his New York Times article, The Unmanned Army, that the future army would be unmanned, which caused US public's intolerance to staff losses (Guest, 2011). Indeed, after the war, the US army shifted from compulsory military service to professional military service due to staff losses in the 1963 Vietnam War.

According to Guest, in 2020, the enemy who fought with the tools of industry is unexpected (Guest, 2011). In the future, the soldiers are expected to fight with advanced technological equipment.

According to Nader, the greatest development for US marine cores is to adapt unmanned systems into their own systems (Nader, 2007). Orders that can not blend human and unmanned systems together will fail.

In 2005, a video conference was held at the US Department of Defense regarding the military systems of the future, and staff were informed about the organization, new weapons and equipment. The conclusion at the end of the conference is: "Wars are won only by technology ..." (Gregory, 2008).

According to Lindquist, unmanned aerial vehicles have an indispensable pre-requisite for future war systems. Class-1 and Class-2 vertical landing-take-offs will take place in the organic organization of the manganese unit, and class-3 PWAs in the organic organization of the battalions. Everyone on the ground will have computer systems in their hands that can connect and direct them to the DRAs (Lindquist, 2004). Unmanned systems are expected to become widespread after the widespread adoption of unmanned systems, such as maintenance and energy (Neal, 2010).

Pryer stated that nano-sized robots, like the bee community, could gather in the building and perform sabotage-like tasks in the future. There is also the possibility that terrorists may commit suicide bombardment with 15-meter radius terrain robots (Pryer, 2013).

According to the Army Science and Technology Desk, the human-centered system in the classical period will be widespread in armies, and platform-based systems will become widespread in the future and the two systems will be balanced in a hybrid environment. The one hundred years of engineering will gradually become a technician. Future armies will be the hybrid arm of engineers and technicians (BAST, 2013). From there it is clear that technicians who have the ability to build systems and manage the tools professionally; they will form the backbone of future military systems.

Scientists interested in humanitarianism have searched how a group of soldiers can work with autonomous and semi-autonomous robots. The research has focused on five issues and will focus on similar issues in future army structures:

1. Human-robot interaction: The human being has the ability to grasp the robot's abilities fully and use it as a force multiplier.

2. Human-system interaction: This program involves the calculation of the workload on the personnel, the enhancement of their abilities and the integration of the system interfaces with the human.
3. Neuroscience: This program includes how neuroscience can be used to improve the performance of soldiers.
4. Social and intellectual networking: examines the communication, decision-making and behavior of personnel in an established military network.
5. Military performance: This program investigates the interaction of the system with the operator as a whole (ARLTAB, 2011).

Researchers have compared the strengths and weaknesses of people and machines for many years. One of the leading scientists on this subject was Paul Fitts, who compared humans and machines in 1951. Born in 1912, Paul Fitts is a scientist and psychologist who has pioneered the laws of the "Fitts Law" by examining human behavior and movement in a pervasive way. According to Fitts, machines will do all the work that people do in the future and dominate people. Even though the world that Fitts is plotting as a science-fiction scenario, the US Defense Department in 1955 stated that human and robots are superior in their work, and it is stated in 2030 that the situation between robots and humans is expected to be the same (Buckley et al. , 2010).

Here, a parenthesis is also useful to open to the sources of error of the robots we call human and machines.

Man and Machine Fault Sources:

1. Errors that can be caused by human error: memory error, forgetfulness, lack of knowledge, lack of experience and fear factor.
2. Errors that can be caused by the machine: Low level of safety,
3. Programming error, lack of resistance to viruses, exhaustion of energy used, misuse or interpretation of information.

E. H. In 1985, Price investigated how people and machines should decide according to performance criteria. The results are;

1. If there is not a big difference between human and machine performance, the decision can give both.

2. If the person's performance outweighs the machine's performance; The decision must be made by man.

3. If the performance of man and machine is not sufficient; neither of them should decide (Buckley et al., 2010).

Generally speaking, there are aspects in which the human being is weak or superior, and the question of which system is superior has not been answered yet. As a result, it is useful to examine the importance of the military field unmanned state in depth by examining the superiority and weaknesses of the unmanned systems in the military, and ignoring the moral dimension of the use of such systems.

2.3.1 Superior Aspects of Unmanned Systems

In this section, the superior aspects of the unmanned systems using the military field are examined by giving examples according to cost-effectiveness.

First of all, it is worth pointing out the advantages of unmanned vehicles. Chengeta describes the advantages of unmanned vehicles as follows: Unmanned vehicles are systems that are operated by operators located away from the battlefield, where operations can be carried out in areas where there is no loss of friendly force and land troops are difficult or dangerous to reach (Chengeta, 2011).

One of the most distinctive features of unmanned land vehicles is that energy levels can do as many jobs as they need without replenishing. For example, a robot on a hill that is tasked with observing the enemy may perform a missed task for a week. But humanitarian units carry out the operation with difficulty without performing the supply activity. As Napoleon said, "armies will walk on their mids ..."

The most important feature of unmanned aerial vehicles is that they are cheaper than human aircraft and the maintenance costs are very low. The DRAs do not need many systems that are needed by pilot aircraft. Instead of an F-22 aircraft costing $ 4.2 million, 40 Predator models can be produced (Guest, 2011). According to the data, the cost of the flight pilot's 1 hour training is 2108 dollars, while the cost of 1 hour's cost for the pilot in the pilot position is 150 dollars (SAB, 2011). As a result, the cost of a pilot is about 14 times the cost of the operator. Operator rooms of unmanned aerial vehicles are shown in Figure 9 (Plaga, 2010). As it can be seen from this figure, in an air-conditioned environment and in a comfortable seat, with the enemies that are miles away. The pilot of the manned plane is trying to use both the aircraft and the enemy to fight against it.

Figure 9 Unmanned Vehicle Operator Rooms (Plaga, 2010).

With the development of unmanned technology, RTA operators have been able to spend less time, resources, and maximum employment on the battlefield. In a 20-month mission, a battle pilot passes 4 months of settlement and leave, while RTA operators are able to serve on the battlefield for 20 months. IHA operators are not exposed to the gravity force, psychological and physical stresses that pilots on the battlefield are exposed to. Another advantage of IDPs compared to human aircraft is that their storage costs are very low. The IDPs can be stored for up to 20 years in temperature-controlled storage. Brzezinski named it bomber in a box (Guest, 2011).

One of the significant effects of robots on the army structure is that it reduces staffing costs. According to Larkin, robotic systems reduce the need for labor related to military operations (Larkin, 2011). Figure 10 shows a comparison of the Predator model RHA with the Liberty model humanoid aircraft (SAB, 2011). There is a need to employ fewer personnel for unmanned aerial vehicles, as obtained from vehicles compared to operators, maintenance personnel, pilots, sensor operators and other personnel. While the Predator model requires a team of about 60 people to operate the IHA, a team of about 100 people is required to operate the Liberty model of the manned aircraft.

Unmanned vehicles can be assigned to jobs that can force a person's physical limit. They can stay longer in the air, on land and at sea, as long as the fuel is available. They do not need any replenishment, they do not eat, they do not sleep, and a relative never says no (Neal, 2010).

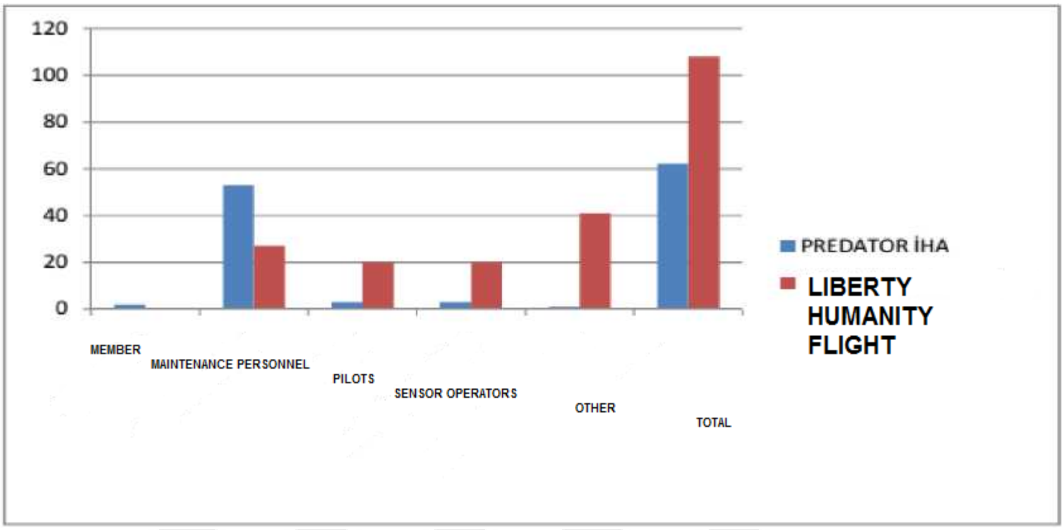

Figure 10 Personnel Comparison of Predator Unmanned Aerial Vehicle and Liberty Manned Airplane (SAB, 2011)

According to Buckley and colleagues, the advantages of unmanned systems are:

• Protect human life: Unmanned systems can easily carry out high-risk tasks for pilot life.

• Reduced labor requirements: As the use of unmanned vehicles becomes more widespread, fewer soldiers will be needed.

• High ability to fight: Unmanned vehicles do not have the stress and fear of fighting because they are not emotional like people. They can fight more effectively on this.

They do not need to protect themselves. In any case they can sacrifice themselves. In the battlefield they are designed to live in fear and not enter into sharks. The stress and psychological disturbances that people experience are caused by robots. When the network-based operation concept enters into force, it will reach the capacity to transmit information faster and to transmit information to people faster than humans. Once humans and robots become a team in the future, those who violate human rights can be easily identified (Quintana, 2008).

The staff ratios of Predator and Global Hawk model unmanned aerial vehicles tasked with combat air patrol (CAP) duty, defined as the air vehicle on patrol ready to fight, are shown in figure 12 (SAB, 2011). According to the rates of personnel in the table, Global Hawk and Predator RHA, the maintenance personnel make up the highest ratio in the system with 36% and 45% ratios respectively. This is followed by the operating team at rates of 34% and 31%. Command-control etc. the proportion of the personnel in the other categories in the duties is 17% and 12%. The proportion of personnel assigned to the sensor operator is 5% and 6%. The proportions of pilots with system and pilot are 8% and 6%, respectively. The four-member Predator team has 168 members and the Global Hawk team has about 300 members. As a result, a four-plane RVA team is approximately equal to one or two infantry divisions.

Table 1 shows the training course durations for the operators of the SSPs (DoD, 2005). Training courses of Global Hawk, Hunter, Pioneer, Predator and Shadow model pilot and maintenance personnel of unmanned aerial vehicles were compared.
The Global Hawk and Predator models have pilots and sensor operators for IDAs, while others have internal pilots and external pilot squads. One of these pilots directs the aircraft and the other pilot or operator uses the weapon systems when the target is reached. The training of pilots or operators is from 13 weeks to 26 weeks.

The pilots of human aircraft first receive a 4 year undergraduate education at the military school level and then have been trained for at least 2 years for the aircraft system to be used subsequently. A total of at least 6 years of human vehicle pilot training is about 12 times longer than the 26-week training period of unmanned vehicle operators.

COURSE TYPE	COURSE PERIOD (WEEK)
Global Hawk. Pilot	26
Sensor operator	12
Maintenance personnel	5
Hunter	8
Internal pilot	24
External Pilot	16
Technician	11
Pioneer task Commander	2
Mechanical Care	7
Technician care giver	9
Pilot	12
Sensor operator	14
Maintenance personnel	4
Shadow operator	24

Table 1 Training Course Duration for HRH Personnel (DoD, 2005).

In the cockpits of man-made jets, there are two pilot supplies according to launch seat, flight systems, parachute, oxygen systems and propulsion. Since unmanned jets do not need such systems, the rate of detection by the enemy may decrease and there may be a chance to integrate more advanced systems. Since the load will decrease, the HAI will be able to fly longer and the maintenance costs will be reduced by half.

The cost of an X-45 is around $ 40 million (Vargas, 2012), while the F-35 war plane, which Turkey is also a producer and a customer, is worth 100 million dolars. It can be easily stated that the replacement of an F-35 manned aircraft is 2.5 X-45 models.

As a result, the advantages of unmanned systems are:

• Human psychology can make more mistakes in complex environments. Unmanned systems are free from emotions.

• Pilots may refuse to fight for some political reasons. In the unmanned systems, such a situation does not occur.

• Unmanned systems are preventing the country troops from losing their lives, and public opinion alleviates the oppression.

• Unmanned systems are more resistant to speed and G forces that force people to live limits.

• Unmanned systems can function longer with the same equipment that human systems have.

• Unmanned systems have the capacity to perform tasks in nuclear, biological and chemical environments. The human system can not function in the pilot environment if there is no protection in the pilot cabinet.
• Unmanned systems are produced at less cost and maintenance costs also require a lower cost.

2.3.2 Weak Aspects of Unmanned Systems

Every system has a weak point, and unmanned systems have weaknesses. Today's unmanned systems, which do not yet have their own will, can be likened to trained animals. A well-trained dog can be used to attack someone else. An unmanned system programmed for attack can also fight under another person's command. When an unmanned system changes owner or when a programming error is made, it can behave in a completely opposite character. This is one of the weakest aspects of the unmanned vehicle. This section examines the weaknesses of unmanned systems.

According to Buckley and his colleagues, the weaknesses of unmanned systems are:
• Technology breakdown: Robots will never have access to the perception, cognition and assessment capacity that people have.
• Moral issues: How moral is it for robots to kill people when it is not morally acceptable for people to kill people nowadays?

2.3.3 Moral Dimension of the Use of Unmanned Systems

The use of new weapons systems on the battlefield, as well as the military, may affect more civilians. The situation of the civilians in the battlefield has also inspired painters like Pablo Picasso. Figure 11 shows the Guernica chart of Picasso's memorial to the civilians who died in the Spanish Civil War of 1936-1939 (Web 55). There is no official agreement or law on the use of unmanned vehicles. A blood to be regulated is a question of the extent to which states will fit. As the famous thinker Çiçero said: "The laws are silent in the battle."

Figure 11 Pablo Picasso, Guernica (Web 55).

The ILMs have been criticized for years because of the civilian casualties in the various regions of the world. Nonetheless, the number of civil casualties caused by IDA in 2004 was 21% of the total number of deaths, but in 2010 it decreased to 6% (Olney, 2011). Considering the years 2001-2011, al-Qaeda and so on. while 20 terrorists were killed by the leader of the terrorist organizations, civilians between 750 and 1,000 lost their lives. About 50 civilians have been killed in order to neutralize a terrorist. Figure 12 shows the attack statistics of the US army in the Afghanistan during 2004-2011 (IAAA) (Chengeta, 2011). According to the table, a total of 9 RIA attacks were carried out between 2004 and 2007, while this number increased to 33 in 2008, to 53 in 2009 and to nearly 118 in 2010. In 2011, the number of attacks decreased to 2010 level and was 60. It is known that the US is also attacking unmanned aerial vehicles with the CIA in the same region. But the CIA data has not been reached.

According to Pryer, 90% of the worldwide war / conflict losses are civilizations. In 1991-1995, 41% of those killed in the Bosnian war were civilians. 1983-2009 Sri Lanka, 1988-2003 Colombia, 1975-1979 In Cambodia, the rate of loss between cattle and rebel was 90% civil and 10% rebel. According to some researchers, the damage incurred by DRAs is lower than in normal wars (Pryer, 2013).

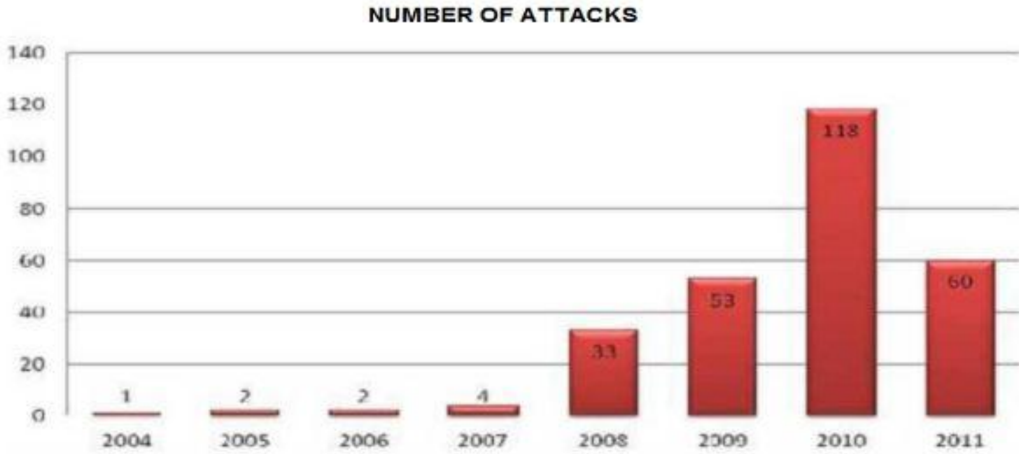

Figure 12 Number of Attacks by US Army in 2004-2011 in Afghanistan (Chengeta, 2011).

According to Baidullah Mahsud, one of the leaders of the Al Qaeda, each IRA attack has given him 3 or 4 suicide bombers. He also said in an interview; "I spent 3 months to get my militia pills between 10 and 15. A US RDA came and bombed 150 volunteers applied ..." (Ahmad, 2009). As a result, countries need to be more sensitive about the use of IDP. However, it is clear from the press that the US did not pay much attention to the attacks on the UAE, which the US practiced in the Muslim region. The killing of innocent civilians is believed to have fallen against the "winning hearts and minds strategy," pioneered by the United States and tackled by troops on paper, (Guest, 2011).

In Pakistan's North Waziristan region, Pakistanı Gul Nazaz, who was exposed to unmanned aerial vehicles, was reminded of the incident day: "When I heard the explosion, I ran into my house and when I arrived at the house, I saw my house was a place. He lost his wife, two sons and two daughters on the attack (Birch et al., 2012).

Figure 13 shows that civilian casualties are experienced as a result of the attacks of the US army with IAA in Afghanistan and Pakistan between 2004 and 2011 (Chengeta, 2011). In 2004, 2005 and 2006, the remarkable civilian casualties did not come to the fore because of the low use of IDHA by the US army in the region in question. The number of civilian casualties, which was around 100 in 2007, has risen from 300 in 2008 to 700 in 2009 and 1000 in 2010, which can be considered a very high number. Among the reasons for this increase in numbers over the years are; misinterpretation of intelligence, disregard of the people living in the region by decision makers, and carelessness or negligence of the operators.

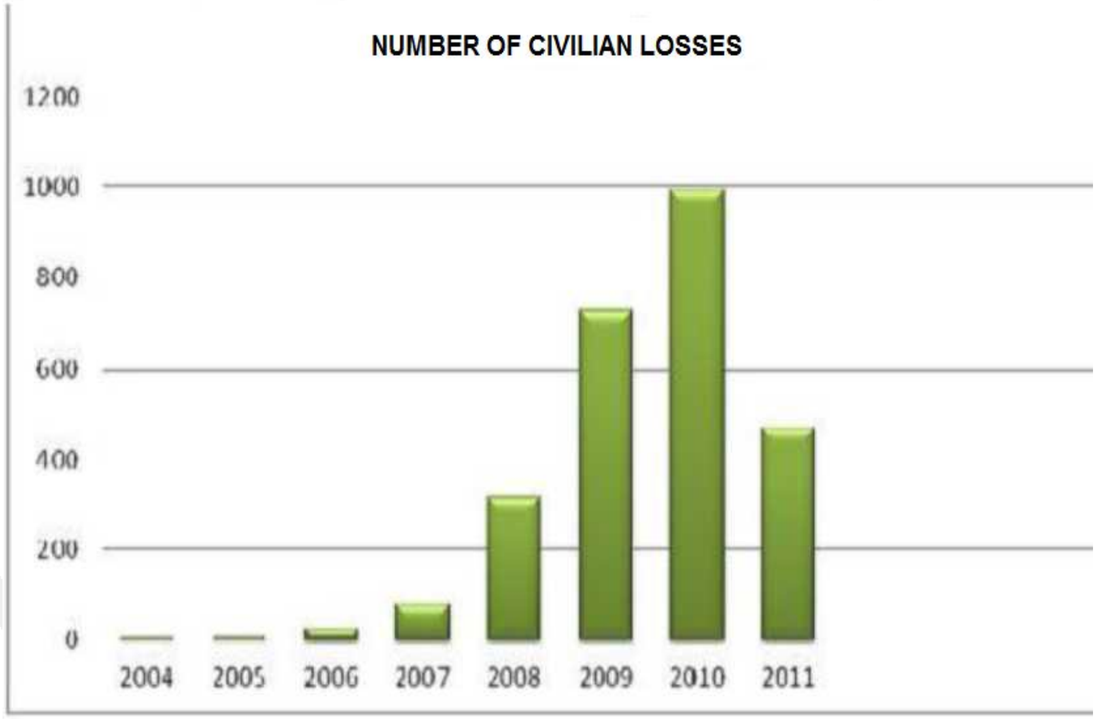

Figure 13 US Army Between 2004 and 2011 Afghanistan and Pakistan Attacked by UAVs Resulting Civil Losses (Chengeta, 2011)

Figure 14 also shows the number of RIA attacks carried out in Pakistan by the US army in May 2012 (Birch et al., 2012). Similar to the Afghanistan data in Table 8, a relatively low number of RIA attacks were conducted between 2004 and 2007, with an increase of up to 4 kata in 2008. In 2010, twice as many attacks on 2009 were carried out. In 2011, the number of RIA attacks, which fell to half the level of the 2010 attacks, fell to one-fourth of the 2011 attacks in 2012 as well. The reason for the decline in the number of attacks is that the Obama administration's policy to change Afghanistan and Pakistan and the image of the United States may be to prevent the people of the region from falling further.

IDAs are primarily used in anti-terrorism and anti-rebel operations. Anti-terrorism operations are enemy-centered operations and are usually carried out on territories of other countries. Anti-insurgent operations are local community-based operations, and the country performs such operations on its territory (Olney, 2011).

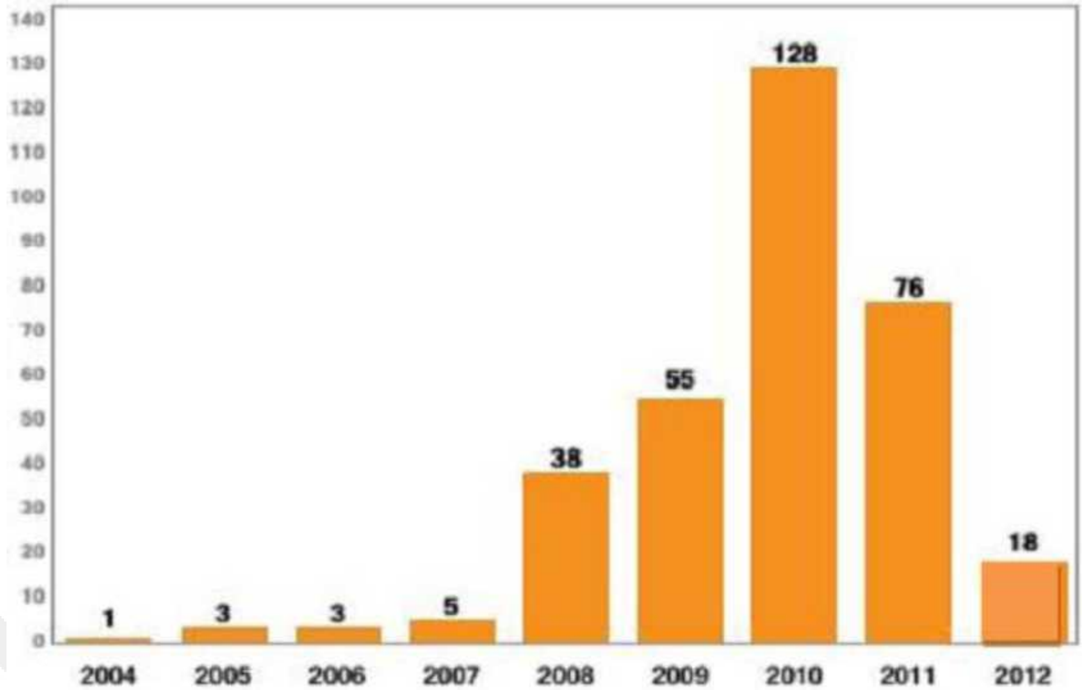

Figure 14 May 2012 Number of Attacks According to the Data of US Army Attacks in Pakistan (Birch et al., 2012)

According to Olney, the effects of the RIA attacks on terrorist groups are:

1. Killing militant groups' leaders is causing dissociation in militant groups. However, the number of members of the organization is increasing.

2. Killing experienced militants causes power loss in organizations because they will take their inexperienced places.

3. Raising civilian casualties while assaulting terrorists with IRAs increases the sympathies to local people's terrorists.

Nevertheless, short-term military success, without the formation of a political basis, leads to long-term political failure (Olney, 2011). It is obvious that the US attacks on the countries such as Afghanistan and Pakistan affect the image of the USA in the Muslim countries and Muslims negatively.

In a publication published in 2011, it is emphasized that there is no international rule or law to which robot and robot platforms depend today, and this is also a very important need (Larkin, 2011).

First of all, it is useful to know what the laws of war are. The laws of war were laid by Augustine and Thomas Aguinas in the 17th century and were compiled by Hugo Crotius. War laws; jus ad bellum (war rules) and jus post bellum (war rules). Jus in bello is made up of principles that determine the behavior of soldiers in battle. Jus in bello consists of four basic principles:

1. Proportionality: refers to the use of force that is proportional to the opposing enemy. For example, attacking with stones, throwing plane bombs, etc. Considering the attacks of the UAE, it is a question of how moral it is to throw a plane bomb in a grub with only a rifle in hand.

2. Military necessity: The question to be asked in this regard is "is there a situation that requires the use of military force?" It is the question. A group of paramilitaries who are seated in a house in Afghanistan is at the moment questioning how dangerous it is for other soldiers or terrorist action.

3. Civil-military discrimination: Civilian and military personnel must be separated from each other. Military personnel are required to wear uniforms. The question of how much civilization and military discrimination can be done with today's technology is not answered. Moreover, when it is judged that the RIA attacks are mostly carried out by CIA-like intelligence agencies, intelligence personnel are not soldiers in the final analysis, nor do they wear military clothing. At the advanced level of technological development, civilian activities have become more military, and military activities have become more civilian (Guest, 2011).

4. Unnecessary pain relief: If there is an enemy soldier, unnecessary suffering and torture should not be experienced. It is not possible to determine how much the bombs from the RIHs have suffered, and there are many civilians who have been injured.

According to Sparrow, there is a similarity between robots and child soldiers. Both are unable to comprehend the moral direction of the action they are taking and can not carry the burden of war. According to Quintana, in case of unmanned systems of war crimes, if the system is completely autonomous, robots that are fully autonomous can not be used according to the "jus in belo" law because they are responsible for war crimes (Arkin, 2008) while in semi-autonomous systems the responsibility will belong to the operator (Quintana, 2008).

According to the International Genoa Convention, it is imperative to wear uniforms indicating the rank of soldiers participating in the war. However, the failure of HRH operators to be on the battlefield and the wearing of uniforms by intelligence personnel is a violation of this law. When modern wars change the nature of the shapes and weapons used, it is estimated that the Geneva Convention should be revised again for modern wars (Guest, 2011). According to Arkin, using robot and people together is the most appropriate way in terms of morality. Because the data saved by the robots can not be deleted. Thus, when a morally unfavorable situation arises, it can easily be determined who is in charge of the robot. In addition, as human beings perform software and programming of autonomous systems, ethical responsibility will also belong to people (Arkin, 2008).

It is a debate about whether robots will be more ethical in the future or if their soldiers are acting more morally nowadays. While it is criticized that the operators who control the robots are not on the battlefield, it is being investigated whether the soldiers are acting on the battlefield according to the ethical rules. The result of a study on marine and land ponds in the United States is as follows;

1. 47% of the land infantry (CP) and 38% of the sea infantry (DP) declared that non-combatants should be treated with respect.

One-third of KP and DP; they declare that if a life is to be saved from them or if important information is obtained from the enemy, it must be done in torture.

3. 45% of CP, 60% of DP; that if any civilian was killed by them, he would not report this to their superiors.

1/4 of the CP, 1/3 of the DP; officers and non-commissioned officers in the position of superior officers have warned them that they should not be mistreated for civilians.

5. 28% of CP, 31% of DP; they do not know how to behave if they are faced with a conscientious situation.

6. Losing a friend during the war causes the moral values to be left on the edge (Quintana, 2008). As a result, it can be understood from the above research that the emotional person is often more cruel than the emotional robot.

CHAPTER III

MILITARY MANDATORY

3.1 History of Unmanned Military Region

Although the history of the military field unmannalization has been shown to be head of the 1900s according to some, II. Apart from some simple model unmanned systems produced during and after World War II, the PQR series of RQs produced by Israel and subsequently jointly used with the US in the 1980s can be regarded as a pillar of military unmanned disarmament. The fact that Pioneer is lucky compared to other unmanned systems is that GPS technology has grown to be used in unmanned systems. This section will examine the history of military disarmament, its development, and the situations in which countries are unmanned.

The first unmanned vehicle was developed by Low in the aircraft category in 1916. In the following years, a limited number of Hewitt Sperry unmanned aircraft were used during World War I. The related systems, which can be controlled by wire and do not have large dimensions, can also be considered as toy airplanes. Film star and model airplane designer Reginald Denny developed the RPV (remote piloted vehicle) model in the first real-sized remote control vehicle category in 1935. In World War I, the German fleet used unmanned boots, which were controlled by a wire called FL (Fernlenkboote), pointing the coast to the war ships. II. During World War II, V-1 fighters, which were assessed in the category of unmanned aircrafts or bombs guided by the radio frequency developed by the Germans, emerged at the end of the war, but did not feel much of a name (Nader, 2007). The radio-frequency German V-1 fuze, also referred to as the "Buzz Bomb", shown in Figure 15, has provoked fear to the British even though it was not effective during the war (Sonmezocak and Kurt, 2008).

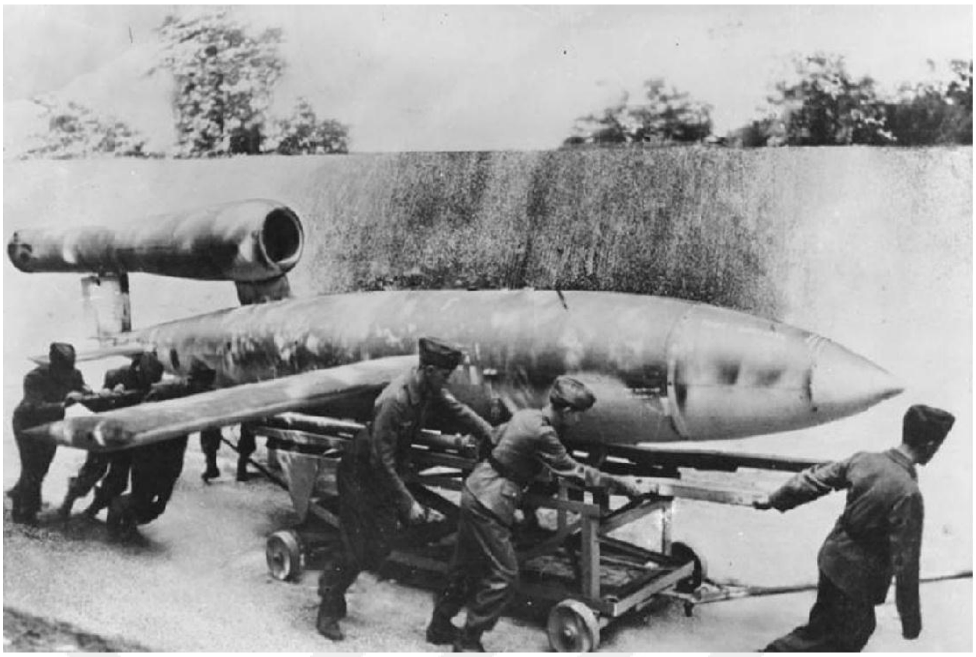

Figure 15 The German V-1 Fuze (Sonmezocak and Kurt, 2008)

II. During World War II, during the Russian-Fin War, the Soviet Red Army used teletank, which could be remotely controlled by wire. Towards the end of the war, there is also the Aphrodite project, which involves the transfer of the US Army's B-17, which carries nuclear weapons, to another target B-17.

The first unmanned aerial vehicle with a jet engine was Firebee (Nader, 2007), developed by Teledyne Ryan firm in 1951 and shown in Figure 17. By 1955, Beachcraft had produced the Model 1001 for the US Navy. These UAVs, which also took place in the 1963 Vietnam War, were no more than a remote control aircraft during the war. By 1964, the US Air Force had produced a simple model of unmanned aerial vehicles called Buffalo Hunter (BiH). The BH, capable of carrying four titles with the C-130D, a modern military transport aircraft, was a radio-guided missile. BiH, which exploded when it reached its target, began to be used in the Vietnam War from the middle of the 1960s and carried out over three thousand bombings. In another project in the same period, the US Navy has installed cameras and transmitters on some of its torpedoes. The remote radio frequency guided torpedoes could be monitored live on television. However, the gyroscope technology, which is used for direction measurement and adjustment, which works with the principle of preserving the angular equilibrium, was terminated due to the inadequacy at that time.

Figure 16 Firebee (Nader, 2007)

After the Vietnam War, an AR-GE group called the National Association of Remotely Piloted Vehicles (NARPV) was established to carry out the R & D activities of the RIHAs, but since the GPS technology of the period was not sufficiently developed, the work was limited.

The unmanned vehicles that matured and shrunk in the 1980s and 1990s have begun to attract the attention of US military circles in particular. The most important reason for this is that unmanned vehicles are much cheaper than aircraft and that the loss of trained crews can be reduced to almost zero during risky tasks.

Under the widespread use of unmanned technology, there is also the opportunity to overcome some costly or problematic items with the technology provided by the developing technology. Unmanned aircraft can be controlled either autonomously or through an earth station, the vital systems required for manned aircraft, the space required for the cockpit, the weight the crew has, and so on. cost items, operational items such as maneuvering and maneuverability of human aircraft by human capabilities (fatigue, working hours, G force etc.), low possibility of being spotted or shot by the enemy. The most important of these is the casualty cost of unmanned aerial vehicles. One of the most costly staff categories to train in all state armies is the pilots.

For this reason, the military vehicle must be wrecked with trained personnel,was also seen as a major loss in the spiritual direction. From this point of view, unmanned vehicles attracted the armies in terms of low cost of casualties.

Unmanned vehicles have historically played critical roles in the distraction of enemy air defense elements and in the use of the main offensive elements as feed to pass the fire line.

The pioneering research and testing of unmanned vehicles in the US Navy is based on the 1950s. The name of the first project is the "Remote Commandable Helicopter" project. The sea squads could use these helicopters for special missions. The disadvantage of the human helicopter was that it had a high load carrying capacity and labor requirement. It was argued in 1954 that the use of an unmanned helicopter instead of a human helicopter could meet military needs more reasonably in a article titled "A Study on the Need for a Helicopter that can be Remote Controlled by Marines." In 1955 the Comon Company and the Land Forces Development Center, Despite the frustration experienced, the AR-GE activities of unmanned vehicles continued with the program named "Bikini". The bikini program started in 1959 and lasted for seven years. Its main objective was to carry out the reconnaissance activities of the battalion command, the bikini vehicles were carried with a jeep and a tractor. There is also a camera with a 70 mm lense that is not bad for that period (Nader, 2007). In the mentioned period, various studies were carried out not only in air and sea but also on land. The so-called "walking truck" was manufactured by Ralph Mosher in 1968 at the General Electric Company's AR-GE laboratory, and was used by the operator with four arms and four pedals, as shown in Figure 17 (Sklar, 2010).

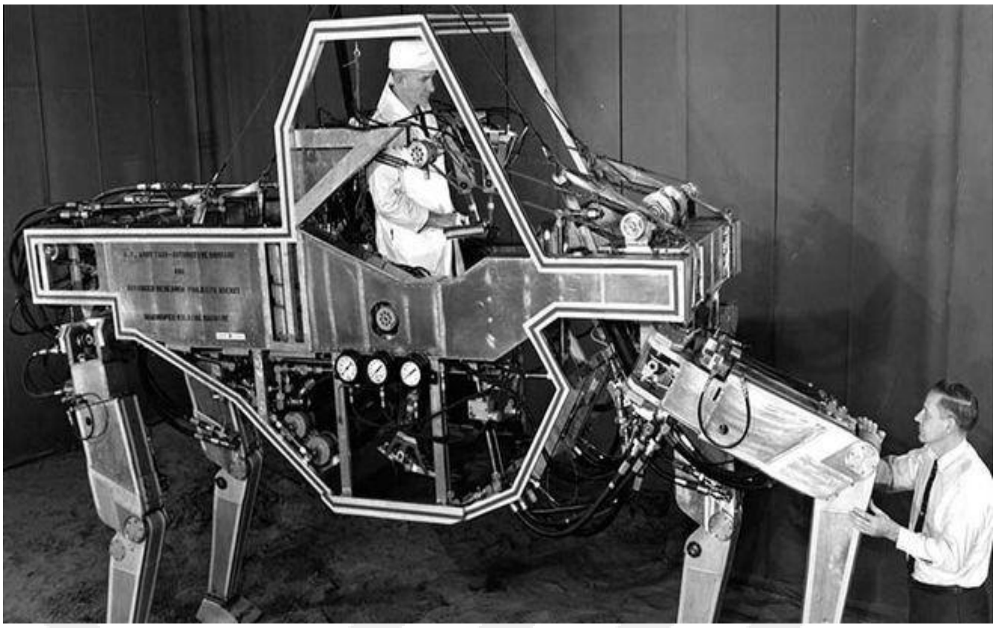

Figure 17 Trucks Generated by General Electric in 1968 (Sklar, 2010)

In 1969, DARPA began work on the development of an anti-submarine helicopter named QH-50, as shown in Figure 18, and the experience of the Bikini project led to production within a one-year period (Nader, 2007).

At the beginning, the QH-50, which could not pass the test stages, was equipped with shortwave television, distance meter laser and 0.50 caliber weapon, and provided reconnaissance and artillery target reconnaissance services during the Vietnam War.

In 1971, 750 of the discontinued QH-50s were produced and 411 adjectives were deprecated for a decade. The Navy developed the SH-2D Seasprite model humanoid helicopter after the QH-50 program and thought it would not be too reliant on unmanned vehicles in critical missions and used SH-2D in the same missions.

Figure 18 QH-50 (Nader, 2007)

3.2 Technologies and Classification of Unmanned Systems

Technologies considered critical for unmanned systems under this heading; communications and sensors, fuel and engines, weapons and materials used for the production of RTAs. In the other part, classification of unmanned systems will be examined according to the region to be operated.

3.2.1 Unmanned Systems Technologies

An examination of unmanned vehicle technology can be briefly made under four headings:

1. Communication and Sensors:
Communication has a critical prescription for unmanned vehicles. Failure or lack of communication can lead to loss of communication with the unmanned system or to the passing of the enemy. While advanced sensors provide the opportunity for unmanned vehicles and operators to identify the environment in more detail, the size of the resulting data (camera image, thermal image, radar detection, etc.) and transmission of

this data through communication means are prone to serious problems. Broader bandwidth is needed for data up to terabytes. In addition, studies are being conducted on the possibility that the unmanned system, which makes a large part of the communication via satellite, can also operate when it does not receive the satellite signal. From this point of view, if full autonomy is provided, there will be no interruption in operation until the GPS signal is received. Ground control unit communicating with unmanned vehicle In Figure 20, mobile control devices are shown in Figure 19 (JUAS-COE, 2010). The ground control stations are planned to be built in order to move easily in the battle zone. Mobile control devices have also been produced to be used for destruction of the vehicle or for operation at enemy depths. A mobile control device operating in conjunction with a power unit; multi-band receiver, mobile antenna system and durable computer.

Figure 19 Ground Control Station (JUAS-COE, 2010).

The connection and information sharing between the unmanned vehicle and the operator can be done via GPS (Archontakis, 2010). This situation makes unmanned vehicles vulnerable to hackers.

When they develop unmanned vehicles, they will also be able to function in bad weather conditions. The weather limits of the DRAs currently used can vary (JUAS-COE, 2010). Accordingly, in the case of icing, there is no defrosting capacity of the DRAs. Breezing winds at speeds of 30 to 90 km / h impose the operational capacity of the IWRs, while winds over 90 km / h constitute dangerous flight conditions. While light rain does not affect the RRH, it can not pass the RRH during heavy rainfall exceeding 5 cm per hour. While it is possible to continue the activity of the HHS in fog and low clouds, dangerous situation can occur in take-off and landing.

Icing, winds above 30 km / h and light rainy weather have no negative effect on the sensors. The image quality deteriorates in over 5 cm / hr of rain. The sensors are not actively working in fog and low clouds.

2. Fuel and engine:

In order for the unmanned vehicle to function for longer, fuel must be efficient and long lasting, and the engine must be of low energy consumption. The new concept envisions the use of small internal combustion engines, small robots and unmanned aerial vehicles (Quintana, 2008).

In the study shown in Table 2 for solving the energy problems of the IKA, the duration of the unmanned land vehicle of various energy systems was examined (BAST, 2002). According to the table, the primary battery supplies energy to the ICA for a period of time ranging from "day to week", while the contribution of the secondary battery to the system is a "day". While the hydrogen fuel cell, the methanol fuel cell, the internal combustion and the externally-burned engine provide energy for the system from "day to week", the contribution of the nuclear isotope system to the "light bulb" is one. As a result, although the most efficient energy solution is a nuclear isotope, internal combustion engines and fuel cells are seen as the best solution in this regard, as there is a danger to be created when the enemy gets caught, and if there is a chance of harming the environment in a possible accident.

PRIMARY BATTERY	OPERATION DURING IKA
SECOND BATTERY	TIME / DAY
HYDROGEN FUEL CELL	HOUR
METANOL FUEL CELL	DAY / WEEK
NUCLEAR IZOTOP	DAY / WEEK
INTERNAL-COMBUSTION ENGINE	MONTH YEAR
EXTERNAL LINE ENGINE (Generator)	DAY / WEEK
PRIMARY BATTERY	DAY / WEEK

Table 2 Energy Solutions for Unmanned Land Vehicles (BAST, 2002)

3. Weapons:

The weapons systems and ammunition that unmanned vehicles must possess must be small, effective and lethal. It is also clear that in the future smart munitions will be preferred over conventional munitions. With the downsizing of unmanned vehicles, weapon systems must also be smaller and have more firepower (Kurkcu and Oveyik, 2008). Volume and heavy weapons and ammunition can cause the unmanned system to consume more energy. As a result, it is important to use nanotechnology, which is used in every field today, for weapon systems.

4. Materials Used:

In order to save fuel, unmanned vehicles must be produced as light as possible. However, armor thicknesses should also help to protect the vehicle and to provide certain protection. The basic criteria for the construction of unmanned vehicles in these circumstances are:

1. Vehicle weight,
2. The duration of study,
3. Working range,
4. Energy consumption,
5. Vehicle speed,
6. Aerodynamic structure,
7. Resource utilization and cost (Valjaots and Sell, 2012).

The new generation X-45C aircraft produced using hybrid composite material has achieved a weight saving of 20-50% compared to the same type of human aircraft. Today, the percentage of materials used in air transportation is almost the same as that of unmanned aerial vehicles. 50% composite material was used on the Boeing 787 aircraft, which can be seen in Figure 21 (NMMB, 2012). This gives an idea of the material that can be used for employees.

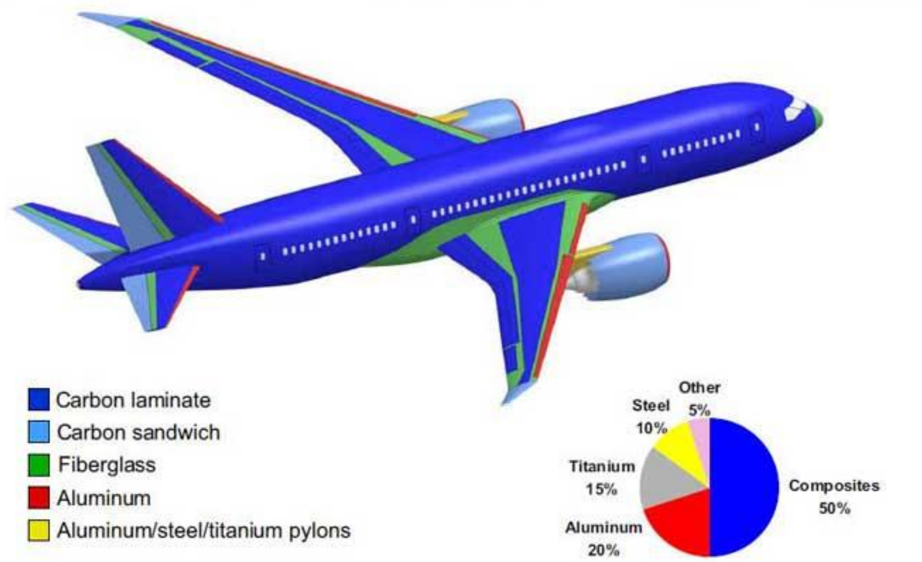

Figure 20. Materials and proportions used in BOEING 787 (NMMB, 2012)

Technological developments have shown that by 2030 the speed of missile systems will be 6+ Mach. Unmanned vehicles must also be very fast as they face very fast threats in the future (Buckley et al., 2010). As a result, the speed of the X-43A aircraft was planned to be 10+ MACs and was produced from much lighter composites.

The cost of titanium, which can be used for the production of aircraft, is quite high. 1 kg. when paid for titanium $ 40, depending on processing 1 kg. The cost of the hardware can range from $ 1 to $ 6. Magnesium plates, with a partial filling of the titanium, the kilogram is one-tenth of the cost of titanium, ie 4 dollars (NMMB, 2012). As a result, unmanned vehicles to be produced in the future will be produced from a wide variety of materials, from magnesium to steel and titanium, according to cost-effectiveness criteria.

3.2.2 Classification of Unmanned Systems

Unmanned vehicles, which are still very new systems in the military arena, are classified differently by states, but even classified within the state can be different. While subdivisions of the main classification are differentiated by the institutions within the state, in general classification as land, air, sea, submarine and space vehicles. For example, while the US Department of Defense categorizes ICAs by weight, The US Land Forces has made a classification according to the wheel, pallet and foot condition.

In the strategy document released by the US Department of Defense in January 2012, land, air, sea, space and cyberspace (Kosina, 2012). Since unmanned vehicles are not expected to function in cyberspace, they are classified into four categories according to the region they serve (Buckley et al., 2010):

1. Unmanned aerial vehicles,
2. Unmanned land vehicles,
3. Unmanned sea vehicles;

a) Unmanned sea surface vehicles,

b) Unmanned submarines,

4. Unmanned space vehicles.

The classification of unmanned aerial vehicles by institutions and organizations can be different. The most commonly used parameters for classification are flight altitude, operational range and operational use. NATO's classification, tactical rescue, medium altitude rescue and high altitude rescue are separated. The tactical UAV's flight altitude is maximum 15,000 ft., Medium altitude UAV 45,000 ft., High altitude UAV 45,000 ft. and the top (Pereira, 2009). There are five types of US Department of Defense classification as shown in Table 3 (Buckley et al., 2010). These; group 1 (or class 1), group 2 (or class 2), group 3 (or class 3), group 4 (or operational RHA), and group 5 (or strategic RHA). The characteristics of the SPAs are as follows:

• Group 1: The maximum take-off weight is 0 to 20 pounds, the operating altitude is less than 1200 ft. And the flight speed is 100 knots. Examples of WASP3, RQ-14A / B, Buster, Batcam, RQ-11B and RQ-16A model RHA can be given as an example.

• Group 2: The maximum take-off weight is between 21 and 55 pounds, the operating altitude is less than 3500 ft. And the flight speed is less than 250 knots. Scan Eagle, Silver Fox and Aerosonde model IDRs are examples of IDRs in this group.

• Group 3: The maximum take-off weight is less than 1320 pounds, the operating altitude is less than 18000 ft. And the flight speed is less than 250 knots. Examples of RQ-7B, Shadow, RQ-15 and Neptune model IDRs are the IDRs in this group.

• Group 4: The maximum take-off weight is more than 1320 pounds, the operation altitude is lower than 18000 ft. And the flight speed is higher. The MQ-5B Hunter, the MQ-8B Fire Scout, and the MQ-1A / B / C Predator model IDRs are examples of IDRs in this group.

• Group 5: The maximum take-off weight is more than 1320 pounds, the operating altitude is higher than 18000 ft. And the flight speed is higher. The MQ-9 Reaper and RQ-4 Global Hawk model IDRs are examples of IDRs in this group.

UAE CATEGORY	**MAXIMUM START WEIGHT (pound)**	**OPERATION CONTACT (FIT)**	**FLIGHT SPEED (knots)**	**SAMPLES OF UAES**
GROUP 1	0-20	< 1200	100	WASP3, RQ-14 A/B, BUSTER, BATCAM, RQ-11 B, RQ-1S A
GROUP 2	21-55	<3500	<250	SCAN EAGLE, SILVER FOX, AEROSONDE
GROUP 3	<1320	<18000	<250	RQ.-7B SHADOW,RQ-15 NEPTUNE
GROUP 4	>1320	<18000	HIGH SPEED	MQ-5B HUNTER, MQ-8B FIRE SCOUT, MQ-1 ABC PREDATOR
GROUP 5	>1320	>18000	HIGH SPEED	MQ-9 REAPER, RQ-4 GLOBAL HAWK

Table 2 U.S. Department of Defense UAE Categories

3.3 Unmanned Systems and Autonomy

Autonomy is an independent or self-directed state or ability. In military sense, autonomy is the degree of human-robot interaction in which a vehicle is assigned to military duty. The autonomous behavior shown in Figure 3.15, shaped by the US Army Science and Technology Panel, is a set of systems starting with the entry of the operator into the system and ending with motor commands (BAST, 2002).

The result of blending the information from the operator input with the information from the robot sensors is a learning action in the robotics system, resulting in a learning behavior. As a result of the commands given by the operator, the unmanned system makes a plan and sends it to the navigation system.

The GPS sensors in the navigation system transfer the position of the unmanned system to the world map and perform detection by means of sensors. The self-locating unmanned system performs learning behavior and sends motor commands to its subsystems. Autonomous action is the whole of feedback systems, in which learning behavior is constantly balanced.

According to Huang, the relationship between human and robot depends on these three variables. For example, when an unmanned vehicle is given the task of "passing from one place to another", the level of autonomy of the unmanned system can be increased as this relative and less human intervention occurs. When a complex task is received qualitatively; For example, if you go from A to B first, then X work on the road, and then another job in Y, the level of autonomy of the unmanned system can also be lowered because human intervention for this relative will increase. Likewise, the level of autonomy of the unmanned system can be lowered because human intervention is required in a complex environment, such as the residential neighborhood.

CHAPTER IV

VEHICLE EQUIPPED WITH WEAPON

4.1 Vehicle Types

Some domestic vehicles and suspension properties which can be used with the weapon platform.

Vehicles	Suspension Types
ACV 19	Torsion Bar
ARMA 6x6	Fully Independent suspension with telescopic type shock absorber & helical spring
COBRA	Helical Coil Suspension
COBRA II	Fully Independent suspension with spring & shock absorber
ARMA 8X8	Fully Independent suspension with telescopic type shock absorber & helical spring
KALE	Fully Independent suspension with telescopic type shock absorber & helical spring
URAL	Double wishbone independent suspension
KAYA II	Helical Springs, telescopic shock - absorber
KAPLAN 20 NG - AFV	Torsion Bar
PARS 4 X 4	Double Wishbone, Independent and Helical Spring
PARS 6 X 6	Independent and Height Adjustable Hydro-Pneumatics
ACV 19	Torsion Bar

4.2 Key features

Some of the key features are:

• Multipurpose Task Ability

• Special Operations

• Personnel Handling Capability

• Infantry Independent Operations
• Mechanized / Armored Infantry
• Low and High Density Battles
• Discovery

4.3 Parameters

Example: COBRA IITechnical Specifications (Personnel Carrier Vehicle Configuration)

General Information

Gross Vehicle Weight	: 12000-13000 kg
TRANSMISSION	: Automatic, 6 forward - 1 reverse
ELECTRİCAL SYSTEM	: 24 V electrical system installation
SUSPENSİON SYSTEM	: Fully Independent Suspension With Spring & Shock Absorber
CREW CAPACİTY	: 9 (Driver and Commander)
LENGTH	: 6000 mm
WIDTH	: 2500 mm
TOTAL HEIGHT	: 2300 mm
GRADEABILITY	: 60%
SIDE SLOPE	: 30%
MAXIMUM SPEED ON ROAD	: 110 km/h

4.4 Vibration modes of vehicles

A swing motion, which a system makes around its equilibrium position, is called vibration. If the oscillation movement T is repeating itself at the moment, such movements are called periodic motion. The simplest periodic motion takes the name of a harmonic motion.

$x(t) = x(t + nT)$

x = Displacement m, radt = Time s

T = Period

n = number of periods

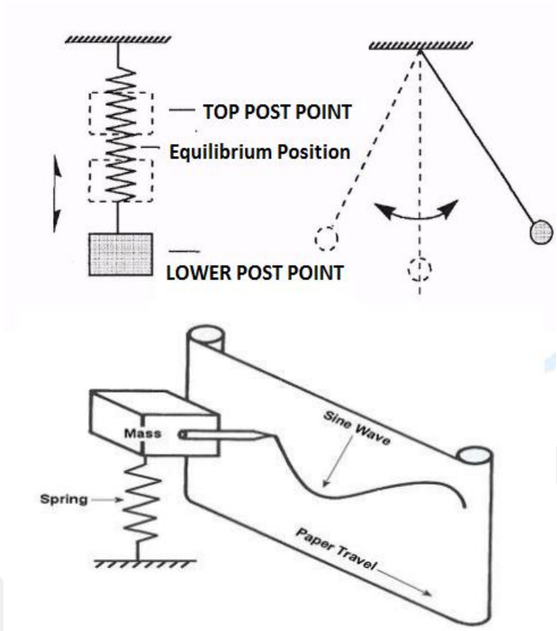

Figure 21 Periodic motion

The simplest periodic motion takes the name of a harmonic motion. Figure 21 shows oscillation and periodic motion. In the context of this oscillation, the vibration modes of the vehicles are thus designed.

The mechanical oscillation movements which occur in the solid, liquid and gaseous environments and which are generally felt during the activities in the solid, liquid and gaseous media, which occur during the activities in the volumes of the environment that are used for purposes other than the usage field and which can occur in the means of transportation, the ground is preparing.

Vibration Types

Free vibration: a kind of vibration that occurs in systems given an initial motion and then released freely. When a child swings on a swing, pushing and then releasing, or hitting a tuning fork, and then releasing it, are examples of this type of vibration. The mechanical system will then vibrate at its frequencies and go to zero.

Forced vibration is a type of vibration that occurs when a varying force or motion is applied to a mechanical system. Because of unbalance, vibration of a washing machine, vehicle vibrations, or vibrations of a building during an earthquake are examples of this vibration pattern. In forced oscillation, the frequency of the oscillation depends on the frequency of the applied excitation or oscillation, but the amplitude of the oscillation depends on the mechanical behavior of the system. If the periodic force applied to a system causes the system to vibrate, this vibration is called the forced vibration. Vibration is maintained by periodic change in warning. Vibration amplitude depends on system parameters and warning characteristics.

The most general expression of a forced movement (4.1) is given by the differential equation:

$[M]\{\ddot{u}\} + [C]\{\dot{u}\} + [K]\{u\} = \{F(t)\}$ (4.1)

In this equation,

M is the mass matrix of vibrating systems,

The C viscous quench matrix,

K elastic spring coefficient matrix,

F (t) is the compulsive external force

u represents the displacement value.

Free vibration starts with a specific warning, and after it gives the system a certain amount of energy, it goes off. In the absence of friction or damping, that is, theoretically, the vibration lasts forever due to the continuous change between the potential energy and kinetic energy of the system involving positional deformation and elastic deformation. In fact, due to friction-induced losses during the change in mechanical energy, the free vibrations decay over time, eventually damping completely. The order of decreasing the vibration amplitude depends on the system parameters. The warning determines the starting conditions of the movement and therefore affects the vibration amplitude. As a result, the main characteristic of this vibration is only a function of the physical properties of the system. If there is no viscous damper in the free vibration, the equation (4.2) occurs:

$[M]\{\ddot{u}\} + [K]\{u\} = 0$ (4.2) (2)

when the equation is arranged according to the harmonic motion;

([K]) ωi 2 [M]) {ui} = {0} is obtained.

Where ωi 2 are eigenvalues,

i represents the values between 1 and the degree of freedom.

The terms {ui} are also called eigenvectors.

The square root of the eigenvalues, that is, ωi are natural circular frequencies.

The eigenvectors {ui} denote the mode shape. "Mode extraction" is a sub-program unit that enables the calculation of eigenvalues and eigenvectors in the ANSYS program. The first mode occurs with the lowest potential and strain energy and helps to understand the natural frequency.

Second and third mode shapes require more energy and therefore contain higher strain energy.

Numerous natural frequency calculations are needed in many engineering problems involving harmonic inputs. They give information on the future dynamic loads. As in the case of natural frequency, in mode shapes, the weight of the structure constitutes the main parameters of mass distribution and solubility. In addition, aerodynamic flexibility plays an important role in the aircraft wing. The common effect of all parameters becomes evident at the moment of inertia. The mass inertia moment and the magnitude of the natural frequency are inversely proportional. In other words, the increase of mass moment of inertia decreases the value of natural frequency.

Knowing the natural frequencies for a design in which harmonic inputs are present is very important because of the need to avoid resonance regions. The main purpose of modal analysis is to determine precisely whether there are natural frequencies that will generate resonant frequencies near the operating frequency or operating frequency range of the system. The method of finite elements used in the modal analysis of complex structures is very good, and sometimes it is the only method. Modal Analysis is used to determine the vibration characteristics (natural frequency and mode shape) of the design at a design stage of a structure. Natural frequency and mode shapes are the most important parameters in dynamic loads. Knowing the natural frequencies and damping values of structures is important in terms of design. The most fundamental problem of vibration engineering is to determine the natural frequencies of dynamic systems and avoid resonance at these frequencies by making design changes or making them difficult. Resonance analysis is simple, such as a shaft, and complicated structures such as airplanes; It forms the basis of vibration analyzes performed for dynamic systems such as mechanical and bridge systems, such as washing machines. (Gundes, 2016)

Figure 4.1 Free body diagram The motion equation if we consider the system as single degree of freedom; $m\ddot{x} + c\dot{x} + kx = F(t)$ Since the equation is not homogeneous, the general solution is;

x(t) = x(n) + x(ö) the homogeneous solution structure is damped with time. The power dissipates. Thus, x (ö) remains as the general solution equation, and is the steady-state equation in this equation.

When the force function is taken as F (t) = F0cos (ωt)

newly formed equation; $m\ddot{x} + c\dot{x} + kx = F0\cos(\omega t)$ (4.3)

special solution; xö(t) = X cos (ωt-ϕ) (4.4)

X: Amplitude

φ: Phase angle

(4.4) take the derivative of the equation (4.3) and write it in the equation (4.3);

X[(k – mω2)cos(ωt- ϕ)-cω sin(ωt- ϕ) = F0cos(ωt) Utilizing trigonometric equations;

cos(ωt- ϕ) =cos ωt cos ϕ+sin ωt sin ϕ sin (ωt- ϕ) =sin ωt cos ϕ cos ωt sin ϕ X [(k – mω2)cos ϕ+cωsin ϕ] = F0 X [(k – mω2)sin ϕ+cωcos ϕ] = 0

From the solution of the above equations;X = $F0$ √[(k−mω2)2+ c2 ω2]

ω2: natural frequency

ξ: damping ratio

δ st: stress

r: frequency ratio

ωn = √ km ξ = ccc = c 2$m\omega$ n = c 2√mk ; cm = 2 ξ ωn r = Ω ω n δ st = $F0$ k

regulated equation; X δ st = 1 √[(1−r2)2]+(2ξr)2] in addition;

ϕ= tan-1 (2ξr 1−r2) obtained.

4.5 Mounting Of Specified Weapon System

One of the most important factors affecting the hit rate in unmanned weapon shooting systems is the design of the suspension system. In addition that the weapon's weight is the one of the factors that influence the occurred flareback force during the shooting of the weapon therefore the assembly design must be corrected mechanically to transfer the weapon's weight onto the suspension. As shown in figure 23, the first step is the mounting of the suspension system that takes part under the gun.

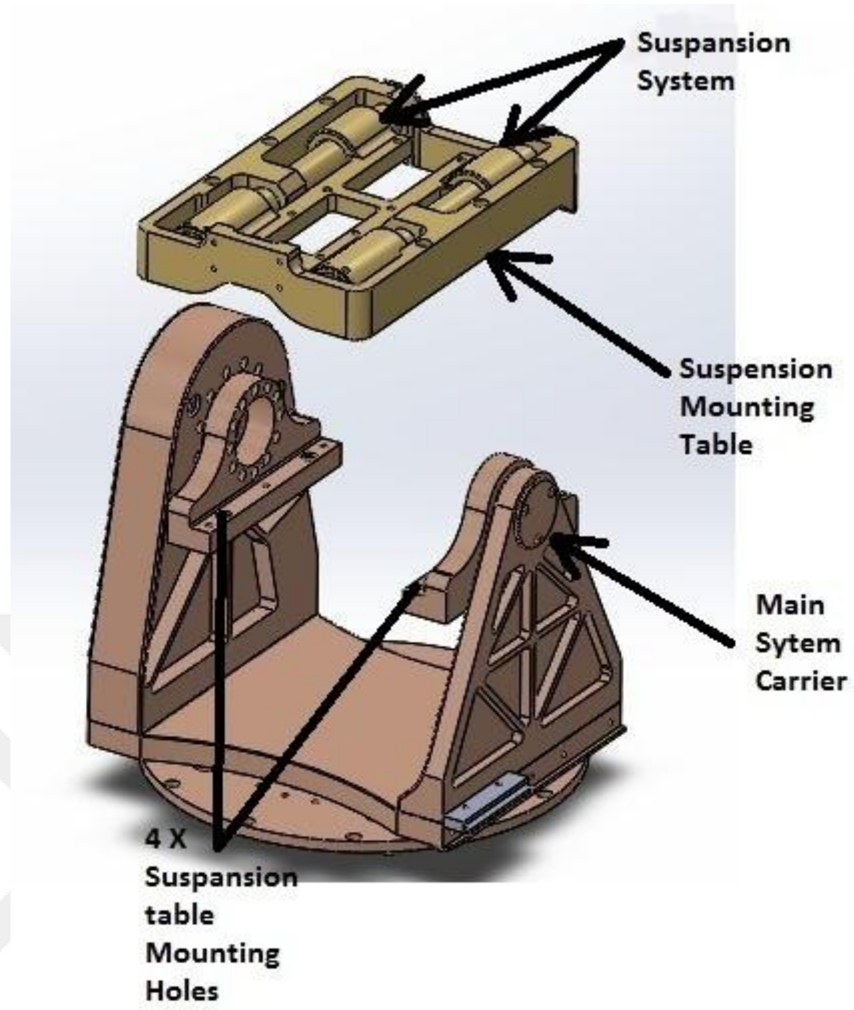

Figure 22 Mounting of Suspension Mounting table

Later on, the weapon will be placed on the system but there are some points that need to be considered. When the weapon mounting is designed, the flareback force was considered to transfer directly onto suspension system while shooting. Besides, convenience of the trigger mechanism take an important place to shoot without any obstacles on this mounting. As a result adhere to the ideas shown on the figure 24 design had been made.

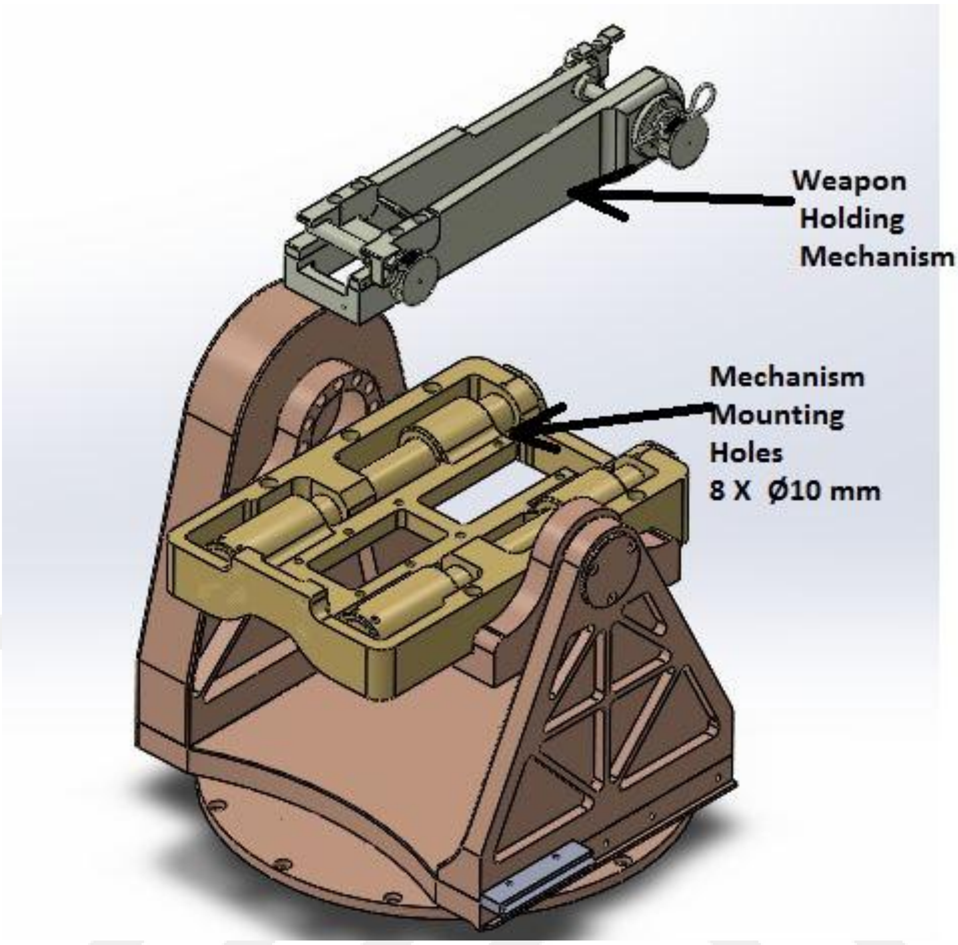

Figure 23 Weapon Holding Part

As shown in figure 25, finally the mounting of the 12.7 mm machine gun takes place on the unmanned shooting system. Gun is mounting with 2 pines onto the holding table by means of 2 holes on the gun.

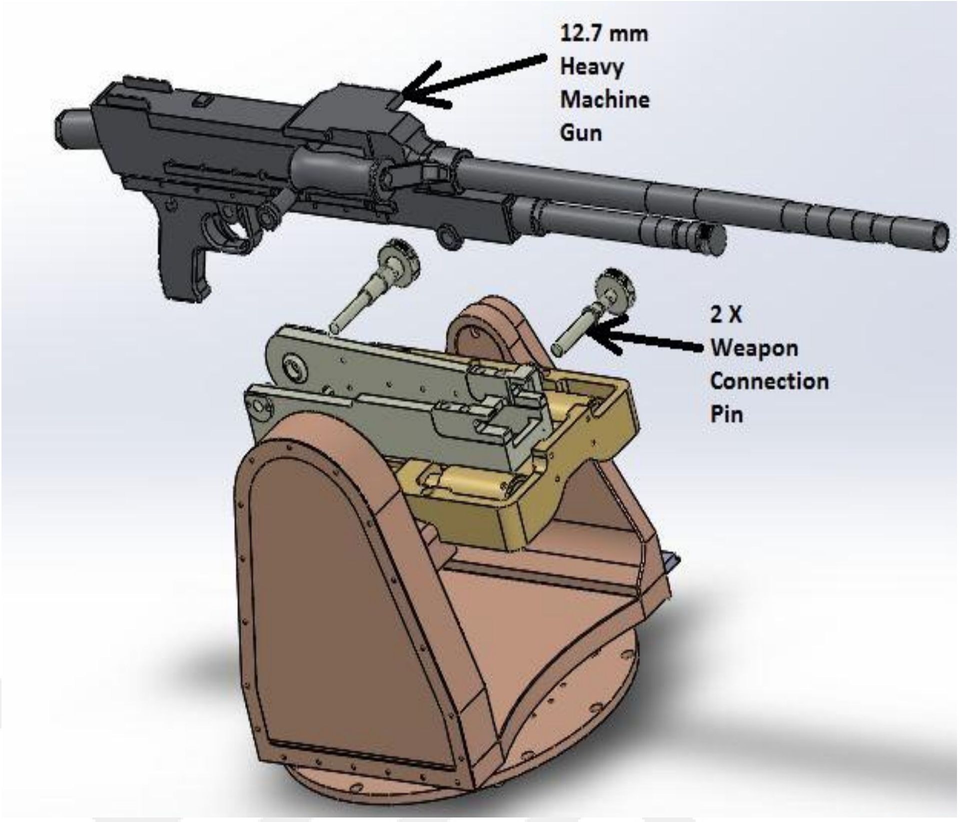

Figure 24 Gun Mounting

As shown in figure 26, after mounting on the vehicle hit rate is very important. The system has 2 main situation to increase the hit ratio that are the electronic gyro device to be used in the system as well as the suspension system on the system for alignment and guidance of the system while car goes or under vibration

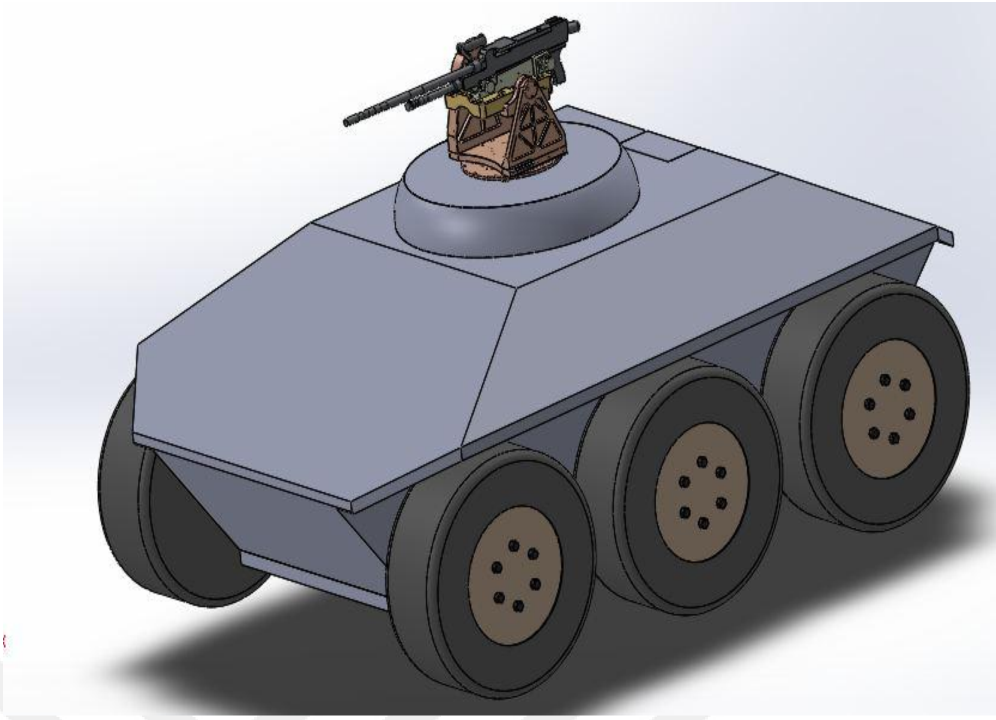

Figure 25 Unmanned Gun Shoot System placed On The Vehicle

The gyro sensor is a system that can sense angular velocity. Gyro measures the rotation speed of the 3 coordinate (X, Y, Z) and is a working tool the principle of conservation of the angular equilibrium. Figure 27 shows the simulink operation of the gyroscope in Matlab and figure 26 (Kevin Craig 2012) this physical model shows a typical MEMS vibratory gyroscope designed to measure the angular velocity of the body about the z axis of the ground reference frame.

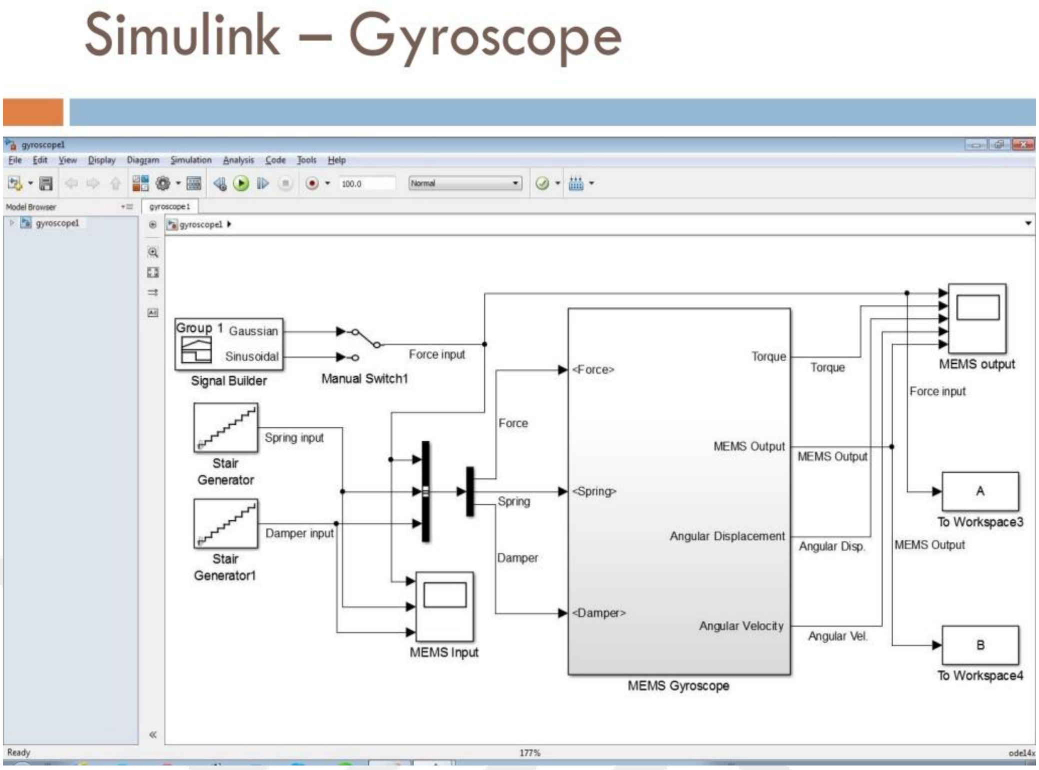

Figure 26 GyroscopeModel in Simulink (Kevin Craig 2012)

4.6 Parameters

Figure 27 12.7 mmM2A1 .50 Machine Gun

M2A1 .50 Caliber Technical Specifications	
Caliber	.50 caliber / 12.7mm (NATO)
Weight (complete gun)	33.74 kg
Barrel Weight	11.79 kg
Elevation:	-5 ° to +70 °
Length	67.75 inches (1,721mm)
Barrel Length	1,143mm
Width	9 inches (230mm)
Muzzle velocity:	890 m/s
Cyclic Rate of Fire	450-550 Rounds Per Minute
Maximum Effective Range	2,000 yards (1,830m)
Maximum Range	7,440 yards (6,800m)

4.7 Modeling

Tests were carried out on the gun shotting system with a barrel diameter of 12.7 mm. The picture of the weapon that used on the system is given in Figure 29. MATLAB program is used in model solution and the flow chart of the MATLAB shows in Figure 30. After shooting, the recoil time is 0.02 milliseconds, the recoil force is 2600 N, and the recoil distance is 0.01 m values was get in MATLAB. The weapon has capable of 450-550 rounds per minute so the MATLAB model was projected with an average of 500 rounds per minute. Matlab has been studied to select the piston that will damping the force generated per single shot.

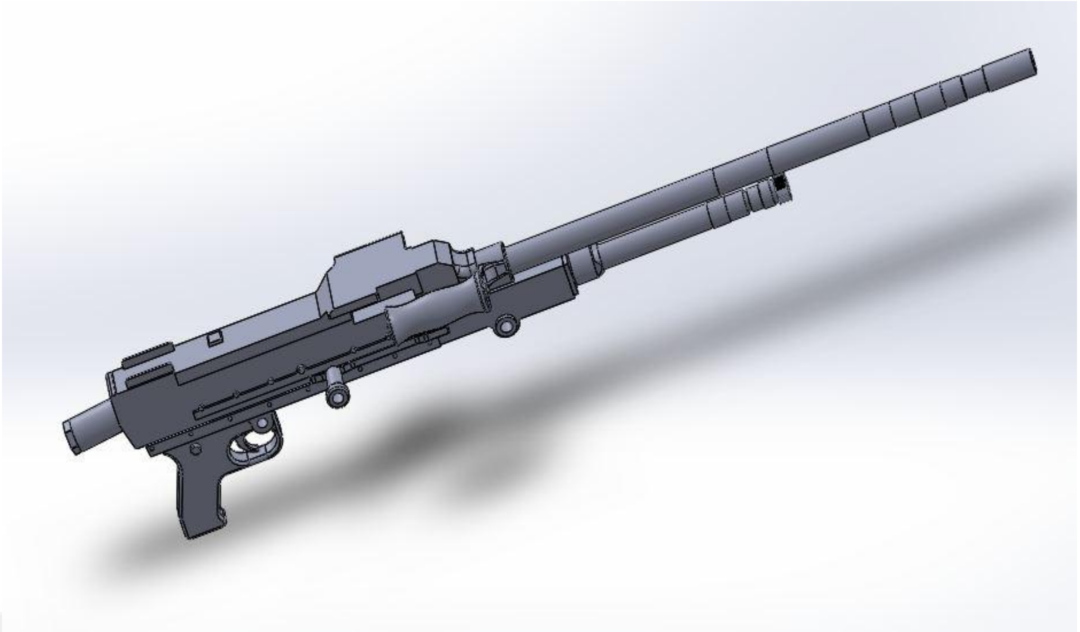

Figure 28 Representative 12.7 mm Made by Solidworks

In figure 30 graph of the affecting factors is given to selection of the piston that will damping the generated force per single shot

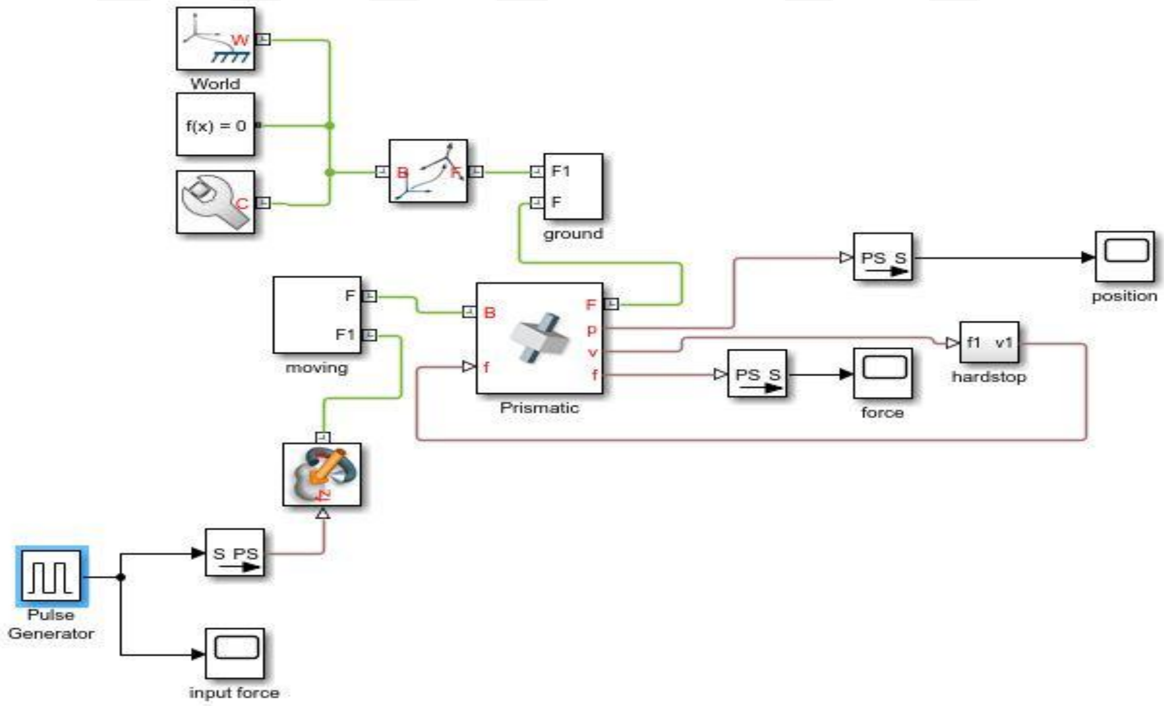

Figure 29 Flowchart of the MATLAB program

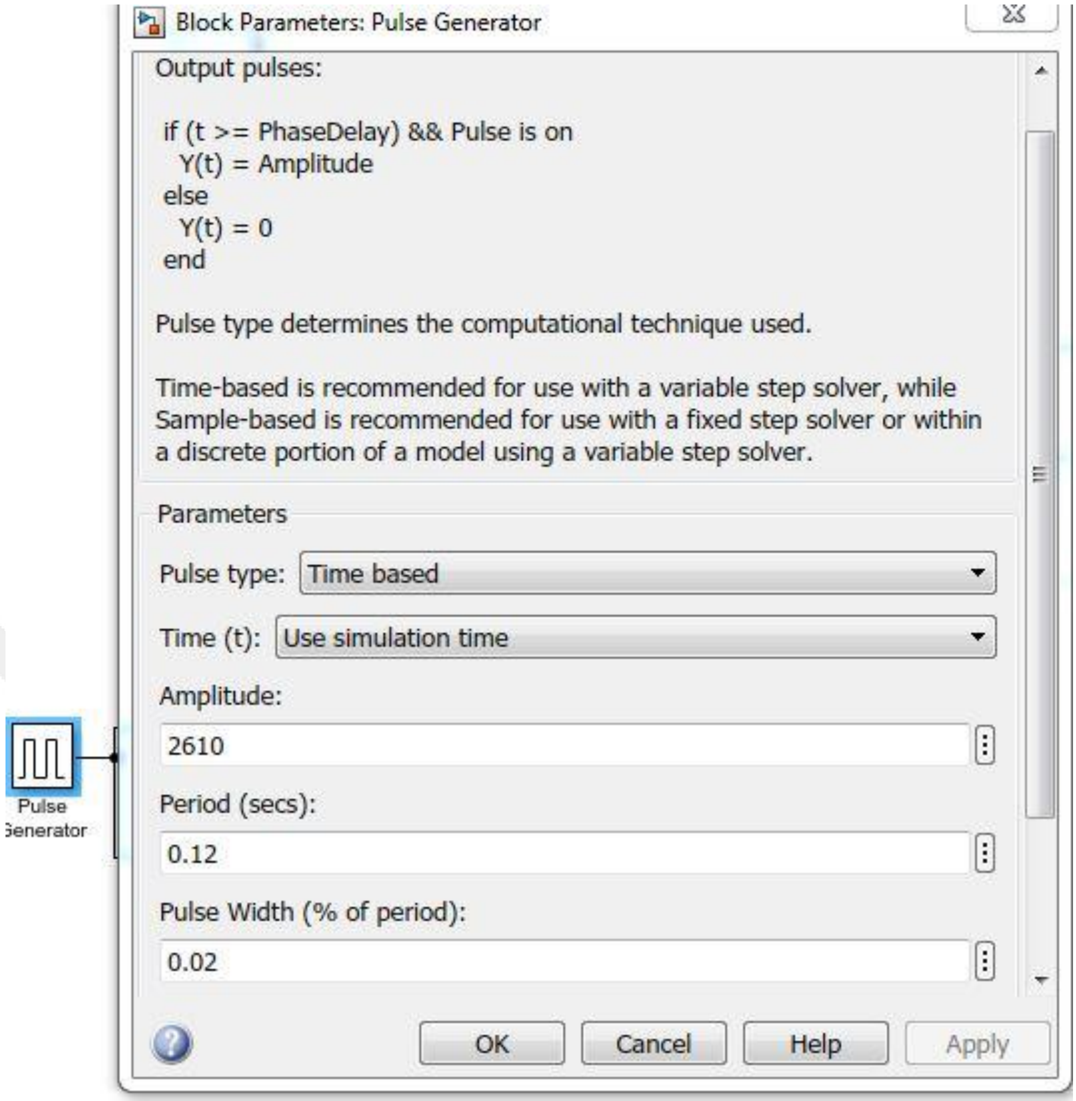

Figure 30 Recoil force of weapon 2610 N, pulse duration 0.12 sec. for single shooting and response time of weapon after shooting 0.02 sec.

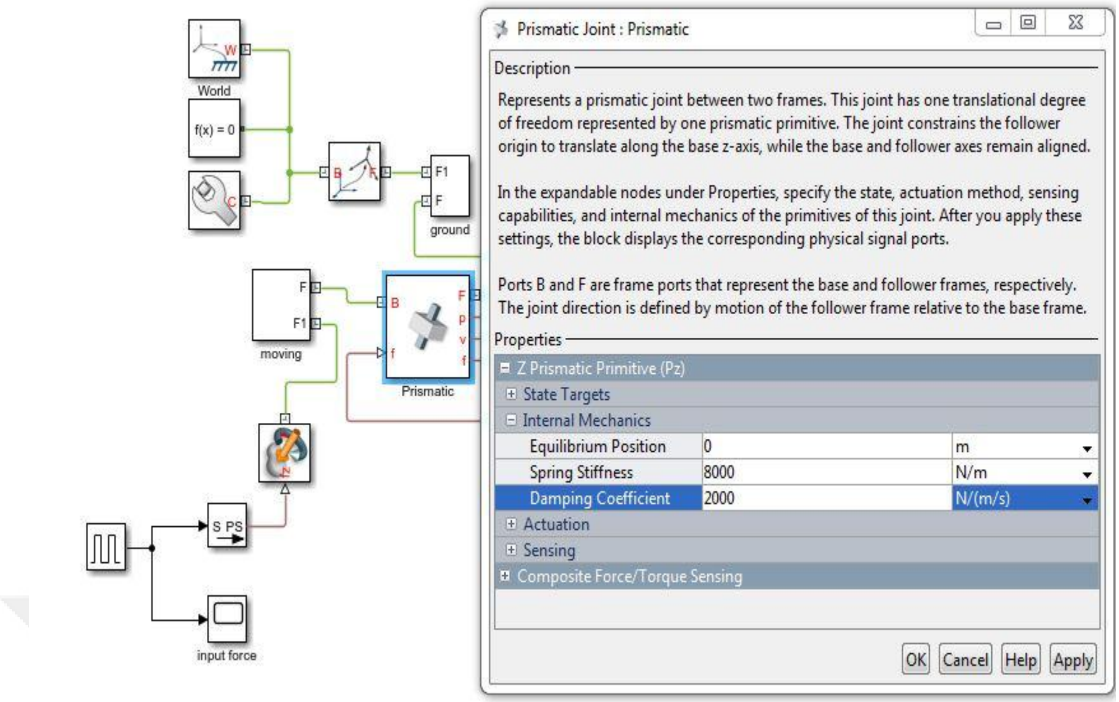

Figure 31 To select piston this values will be used to damp the force that occurs during shooting

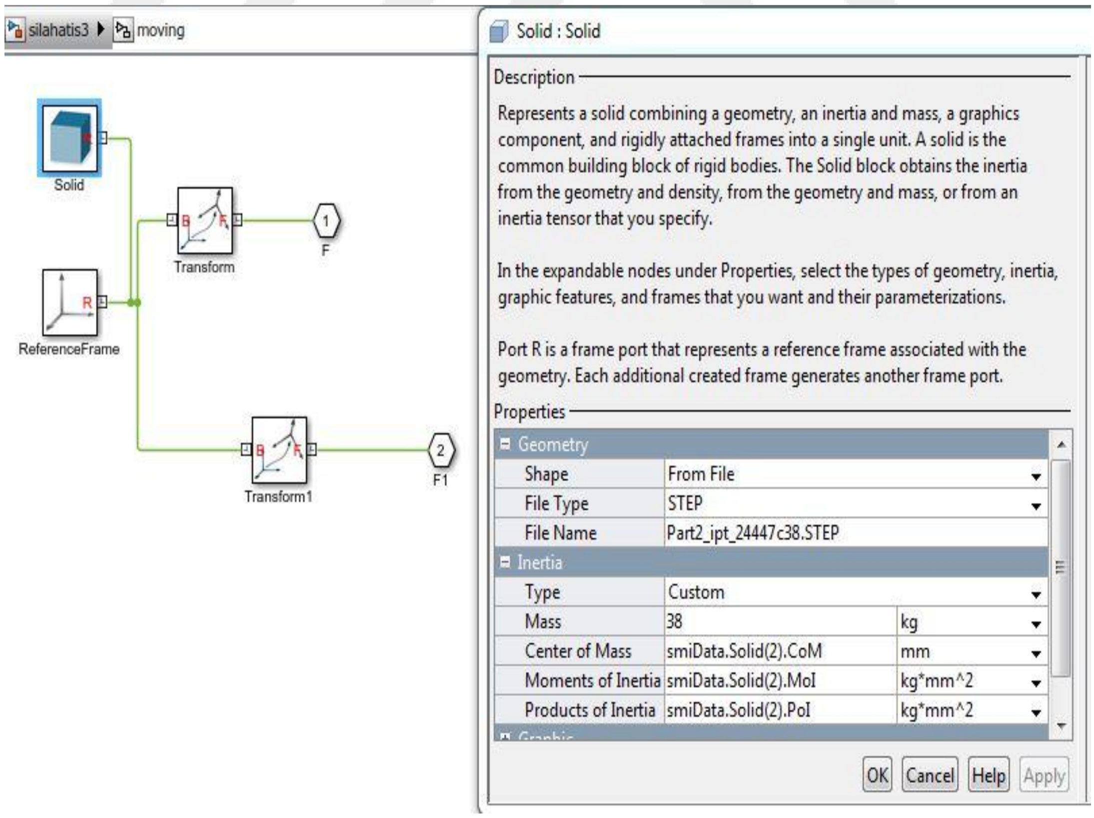

Figure 32 Weight of the weapon

Figure 33 shows us that One of the acting on the backlash is weight of the weapon so we should give input this weight.

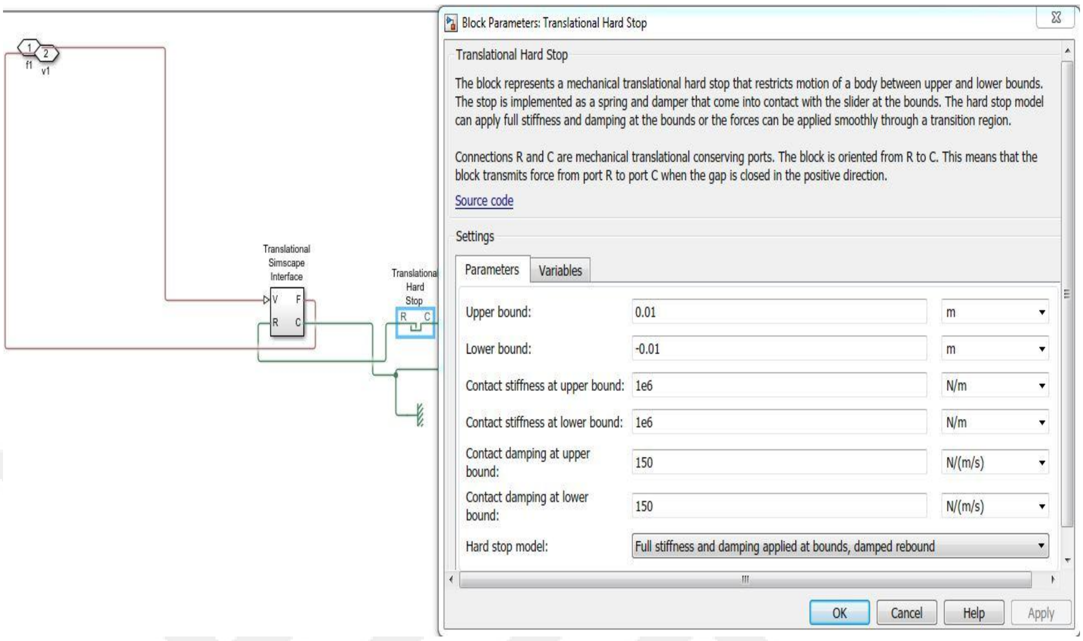

Figure 33 Movement distance of the weapon on the system 0.01

4.7.1 Backlash Dynamics

In the design of the backlash mechanism it is assumed that the support portion of the gun mechanism is not moving and a degree of freedom model is used to describe the backlash motion. A degree of freedom model describes the displacement (linear motion) in the direction of the recoil motion. In this model, it is assumed that the backbone structure is rigidly fixed to the place. Actually, the backbone structure scan move aside but this moving can be neglected in calculations because it is very small.

4.7.2 Motion Equation

After shooting, backlash mechanism start to apply force that has stopper effect barrel and other parts.Recoil parts stop immediately after the parts reaching to stroke distance and move forward again to take the shooting position. This second part of the movement is defined that gun come back to place.

Three forces are effective in backlash:

- Moving Force:The force of the ammunition explosion which will give first movement it is caused by the pressure that is produced by the resultant of explosion and acts in a short time.The force initiates the first backlash motion also.

- Force Of Gravity:This force occurs during the shooting according to taken different barrel anglesdue to rebounding parts weight. The force created by gravity is also constant because of the rebounding parts stay fixed at the firing angle.

- Clear Stop Force: The resistance force generated by the friction force and the backlash mechanism against the backward movement.

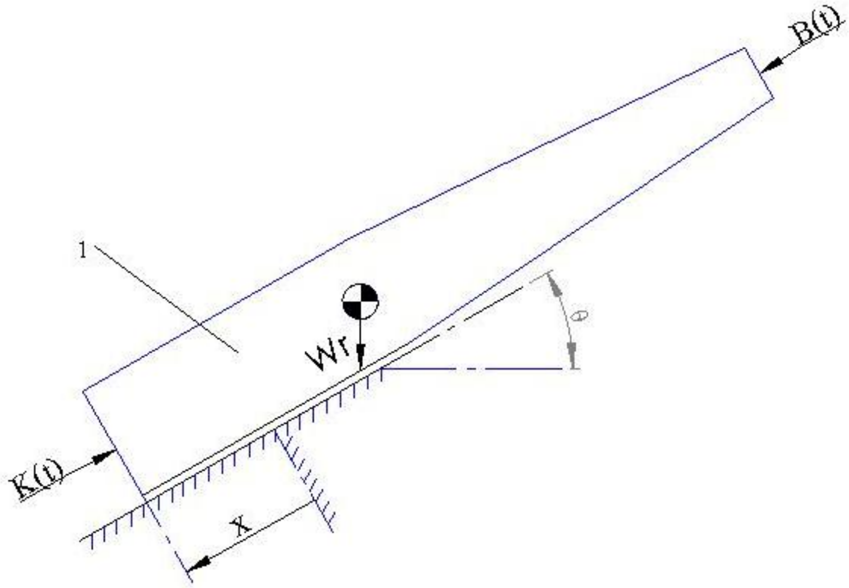

Figure 34 A degree-of-freedom model of rebound parts (Taşkıran 2010)

From Newton's equation of motion, the equation of motion of a single-degree-of-freedom system is written as:

$$M_{\mathrm{r}}\left[\frac{d^2x(t)}{dt^2}\right] = B(t) - K(t) + W_{\mathrm{r}}\, sin\theta, N\text{quation (4-13)}$$

x (t): Movement distance of the parts (m) B (t): Wedge force (N)

θ: Barrel firing angle (rad) K (t): Stopping force (N)

Wr: Weight of recoil parts (N) 1:Representative weapon

m: Mass of Backlash parts

4.8 Vibration control In Matlab

Tries were done to make the correct piston selection. In the experiments, different spring stiffness(k) and damping coefficient (c) values were entered and the desired graph was obtained. The aim here is to be able to choose the correct damping piston against the formed force that the gun gives back during the shot. the spent time in a single shot is 0.12 seconds and after that time the piston must come back. We have to find the right graph in the direction of these wishes.

Tested at different spring stiffness(k) and damping coefficient (c) values experiments

K	5000	6000	7000	8000
C	1000	1000	1000	1000
	1500	1500	1500	1500
	2000	2000	2000	2000

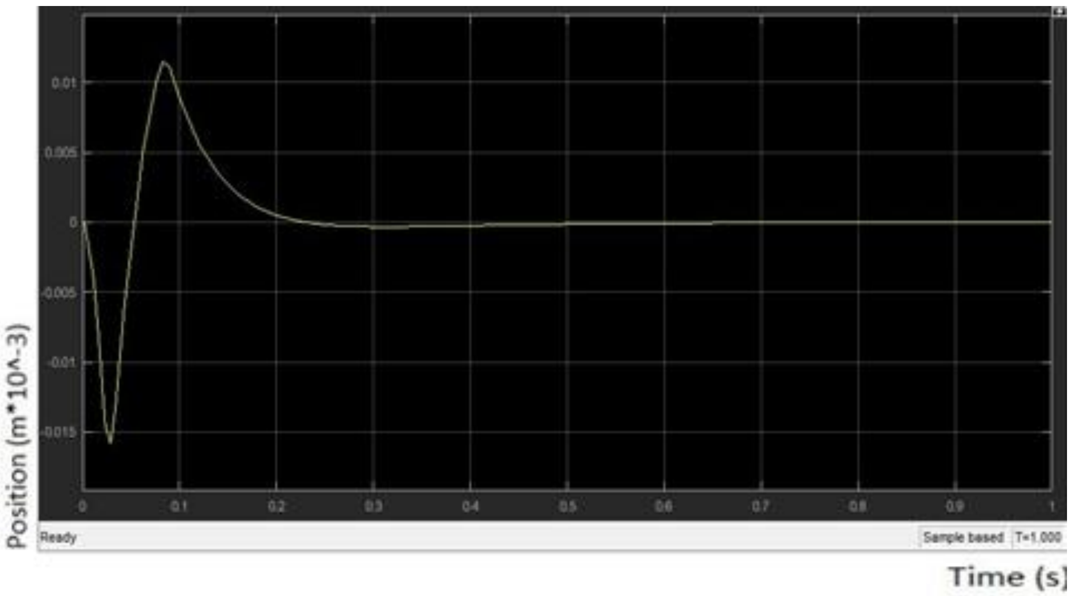

Figure 35 K 5000, C 1000

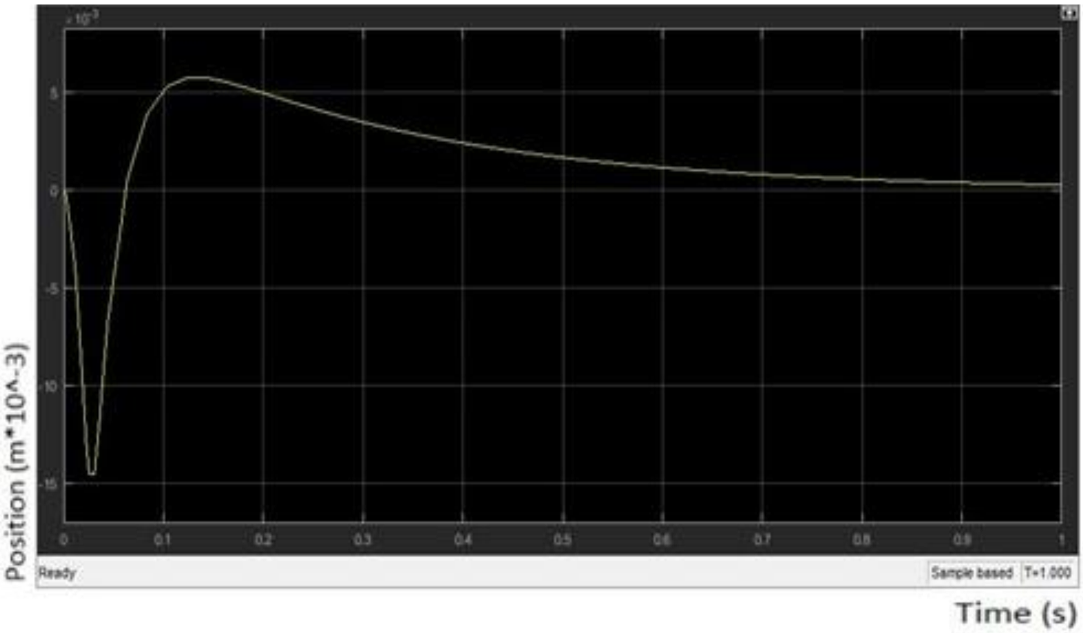

Figure 36 K 5000, C 1500

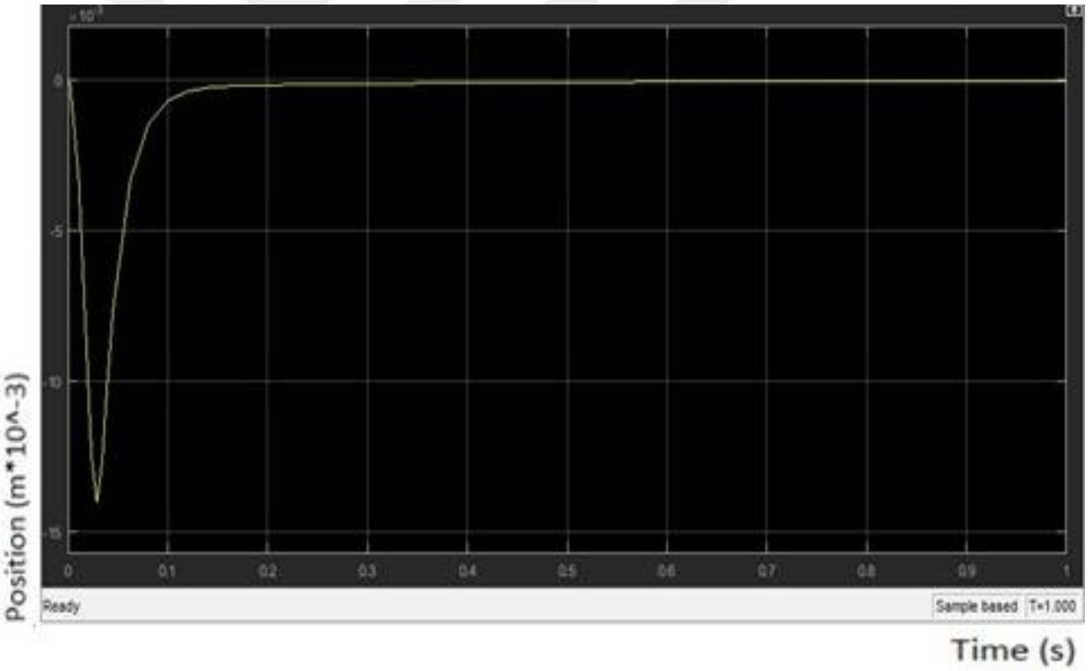

Figure 37 K 5000, C 2000

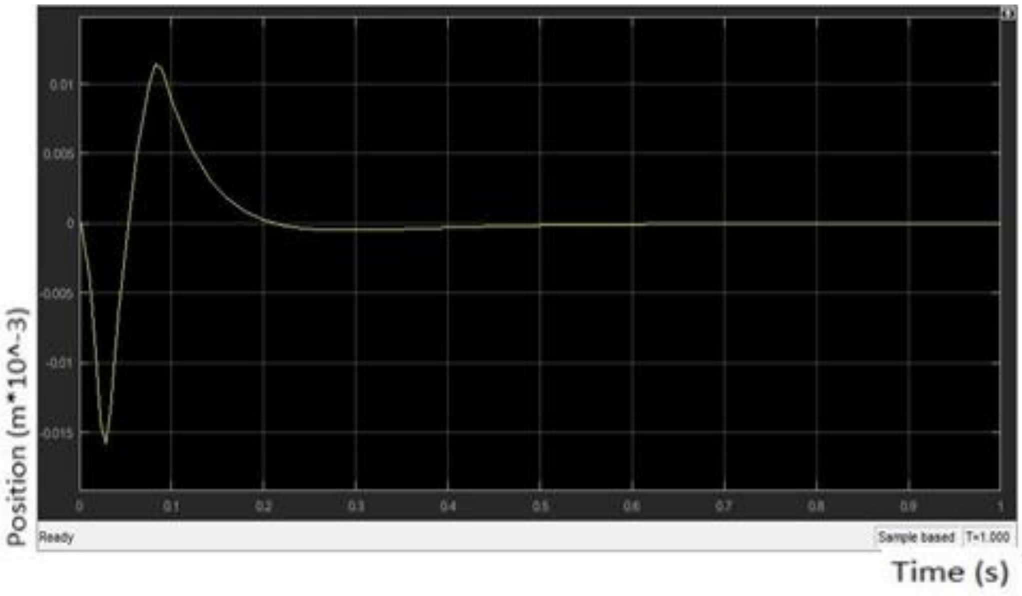

Figure 38 K 6000, C 1000

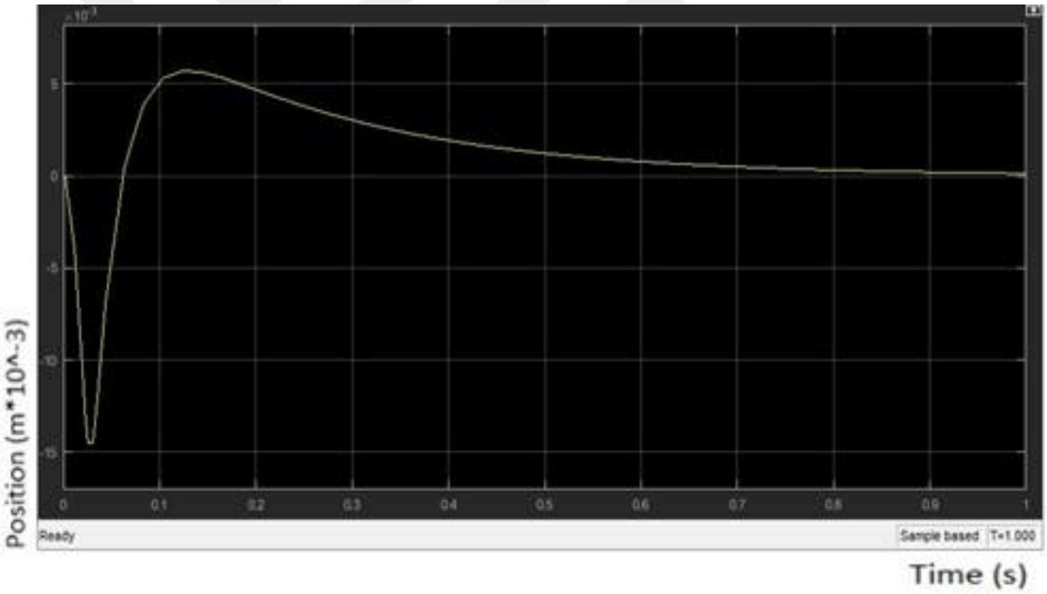

Figure 39 K 6000, C 1500

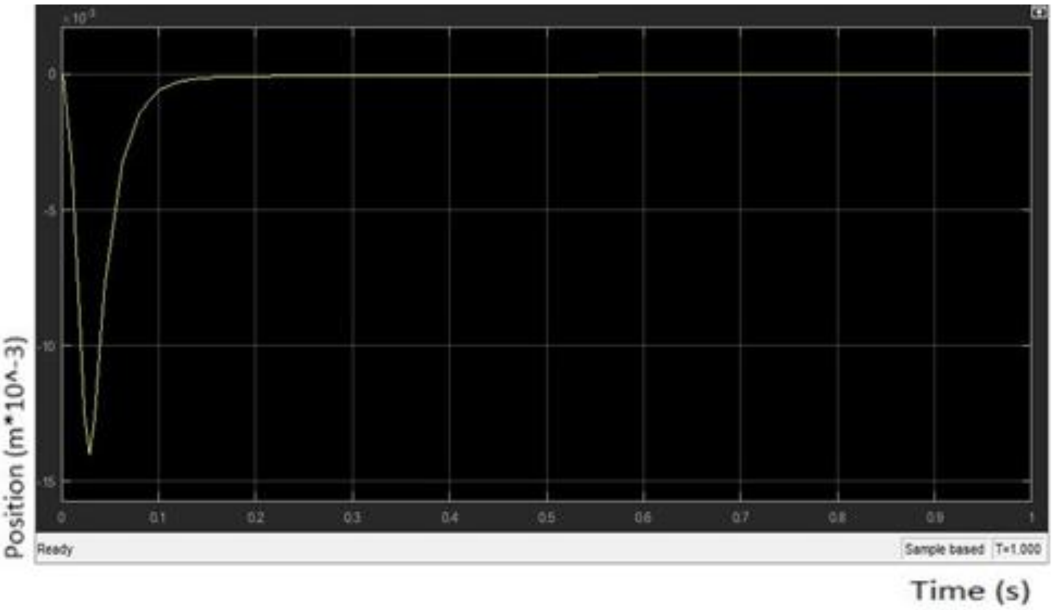

Figure 40 K 6000, C 2000

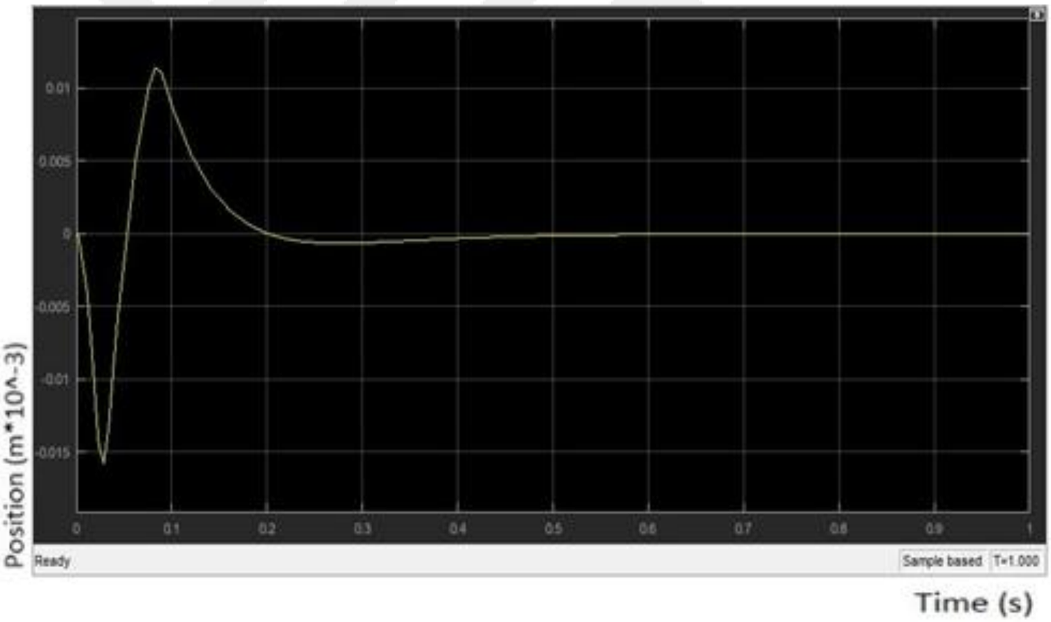

Figure 41 K 7000, C 1000

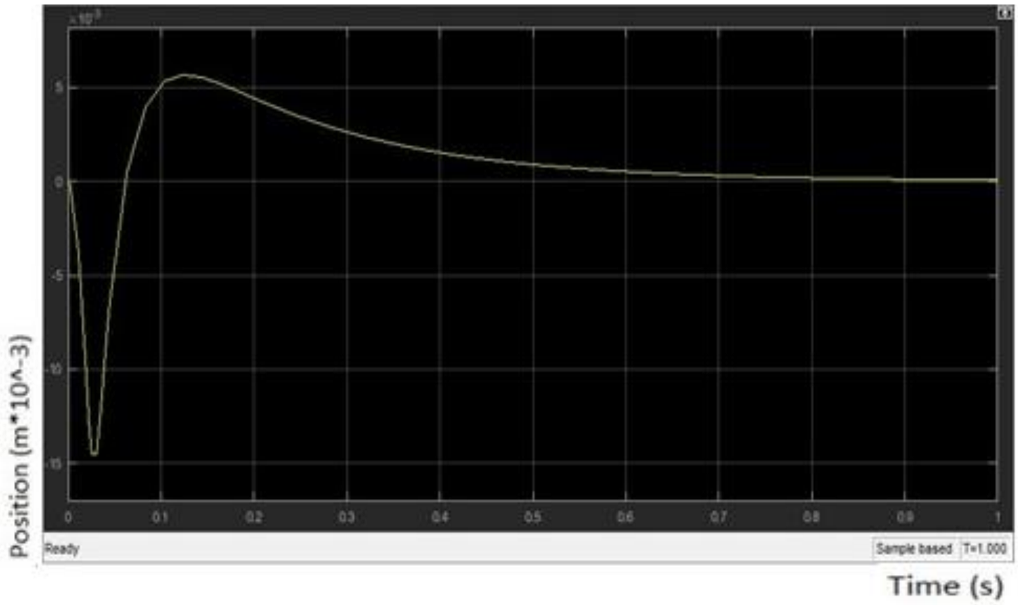

Figure 42 K 7000, C 1500

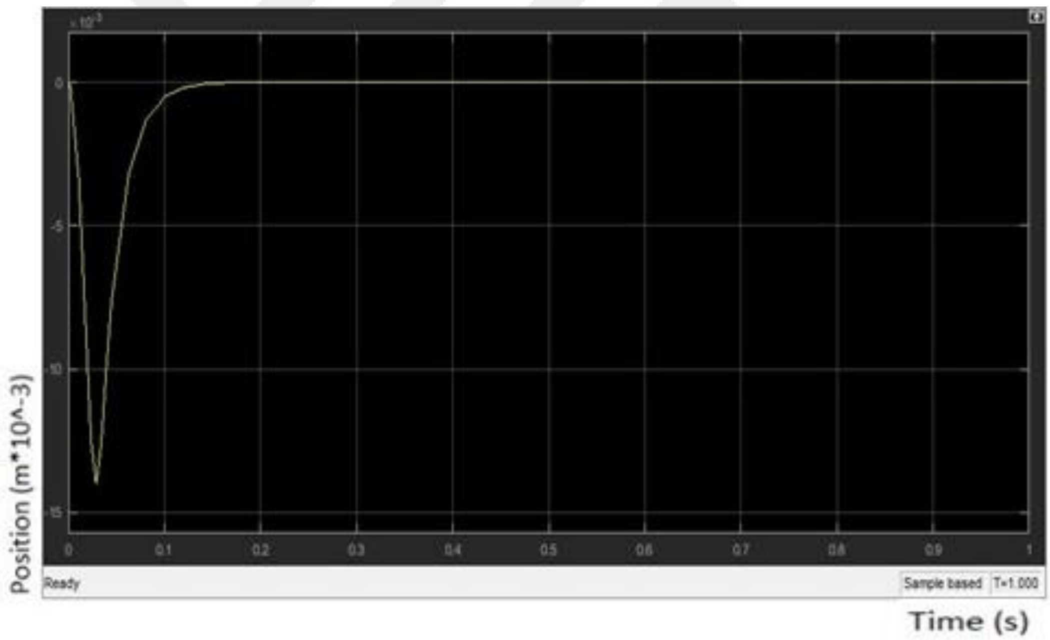

Figure 43 K 7000, C 2000

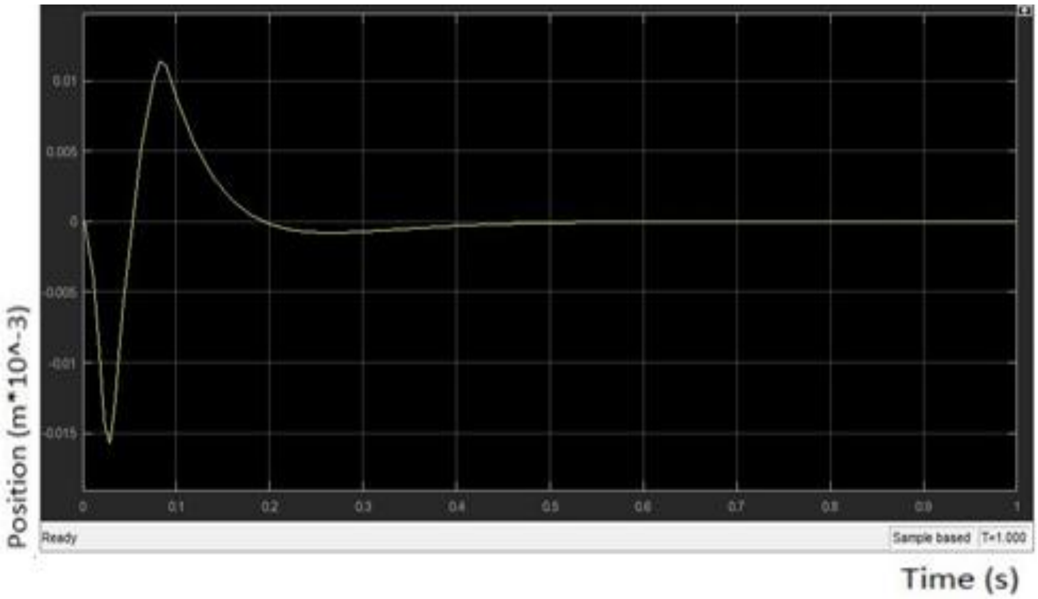

Figure 44 K 8000, C 1000

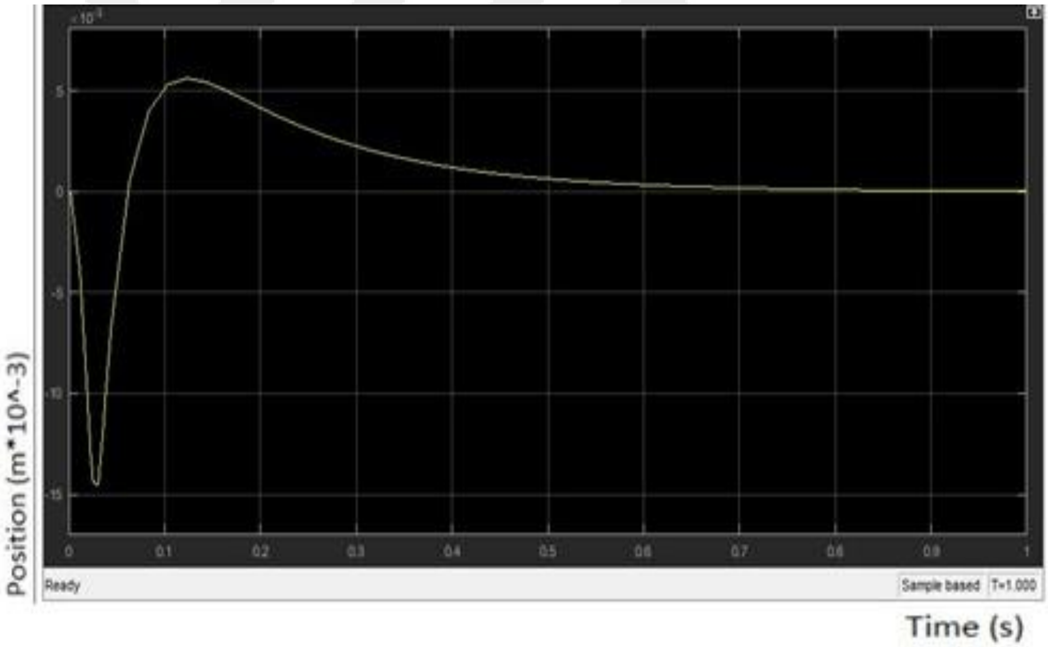

Figure 45 K 8000, C 1500

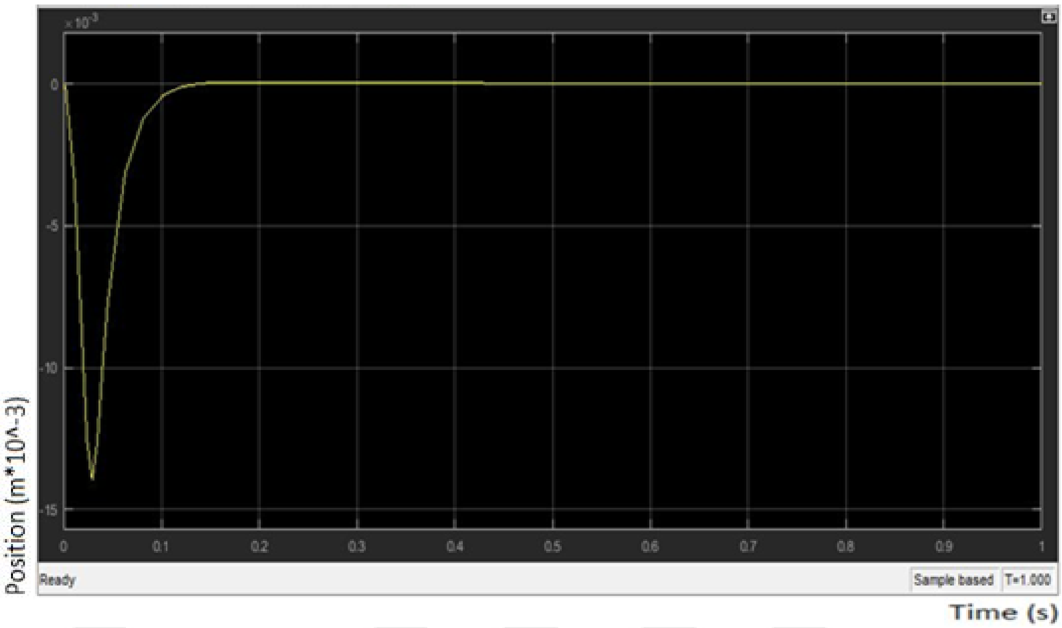

Figure 46 K 8000, C 2000, after single shooting the recoil distance-time graph obtained according to the created model, piston comes back at the time(0.12 sec.)

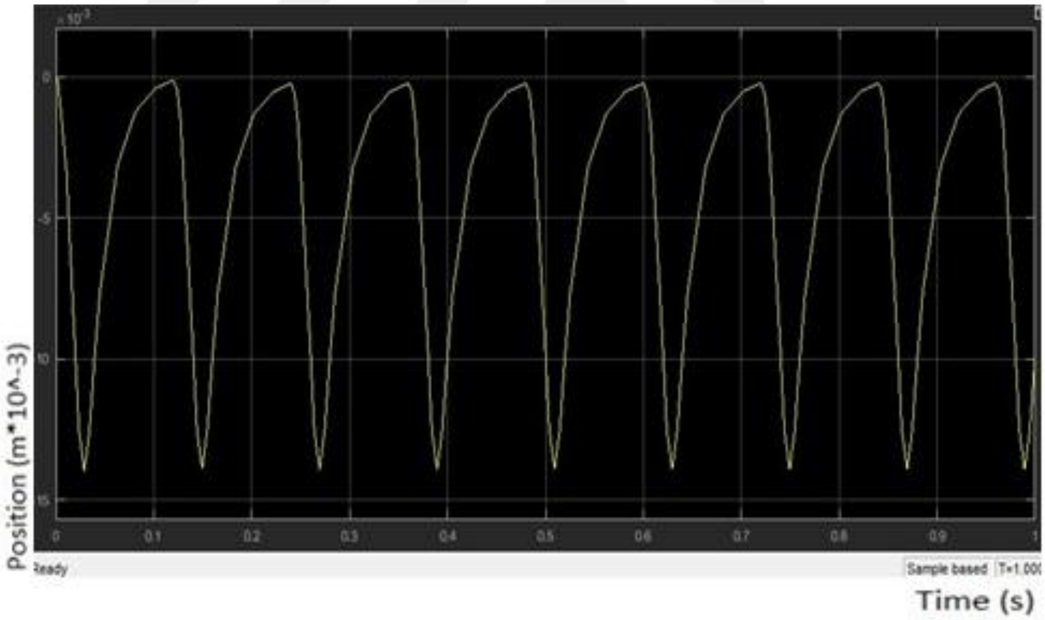

Figure 47 K 8000, C 2000, after burst the recoil distance-time graph obtained according to the created model

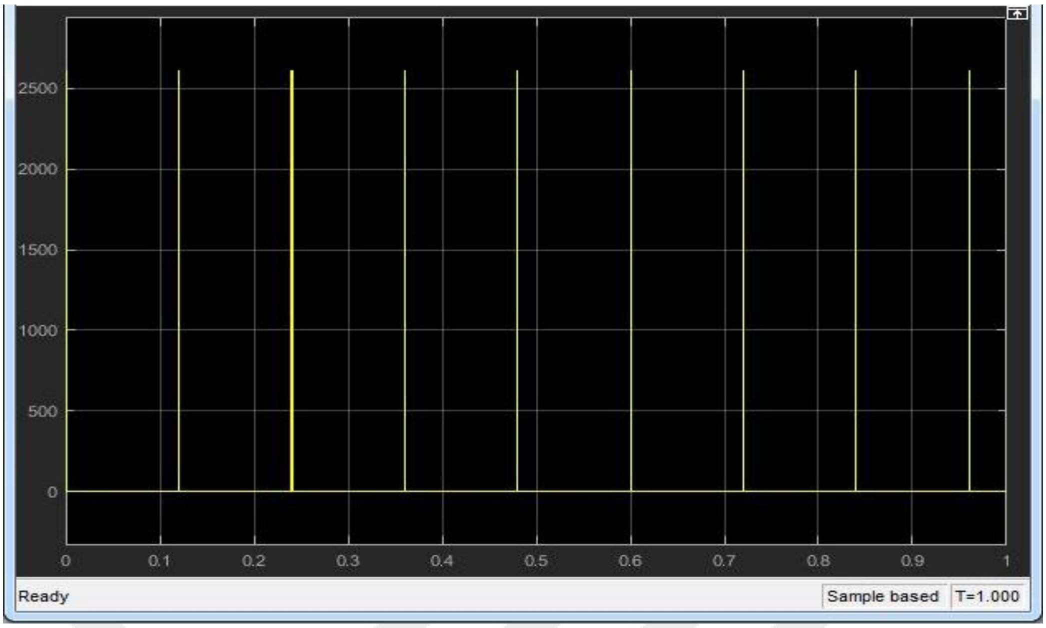

Figure 48 The force chart of the pistol, depending on the time, during a 1 second serial shot

4.9 Transient Analysis

The material used in the system that is aluminum T6-6061. During operation can be occurred some deformations on this system so i should chose accurate material. Because piston mounting plate hits to counter-wall so it may create some deformations. Because of this, i need to do analysis to see the deformations before it will be manufactured. In the present case, design would be improved according to this result. In below i show this analysis result and i have met with the result what i hoped.

T6 6061 Aluminium Alloy	
Tensile strength (σt)	124–290 MPa (18.0–42.1 ksi)
Density (ρ)	2.70 g/cm3
Yield Strength	240-270 MPa (min-max)
Tensile Strength	260-310 MPa (min-max)
Extension	20 (%50) min-max
Stiffness (brinel) min-max	95

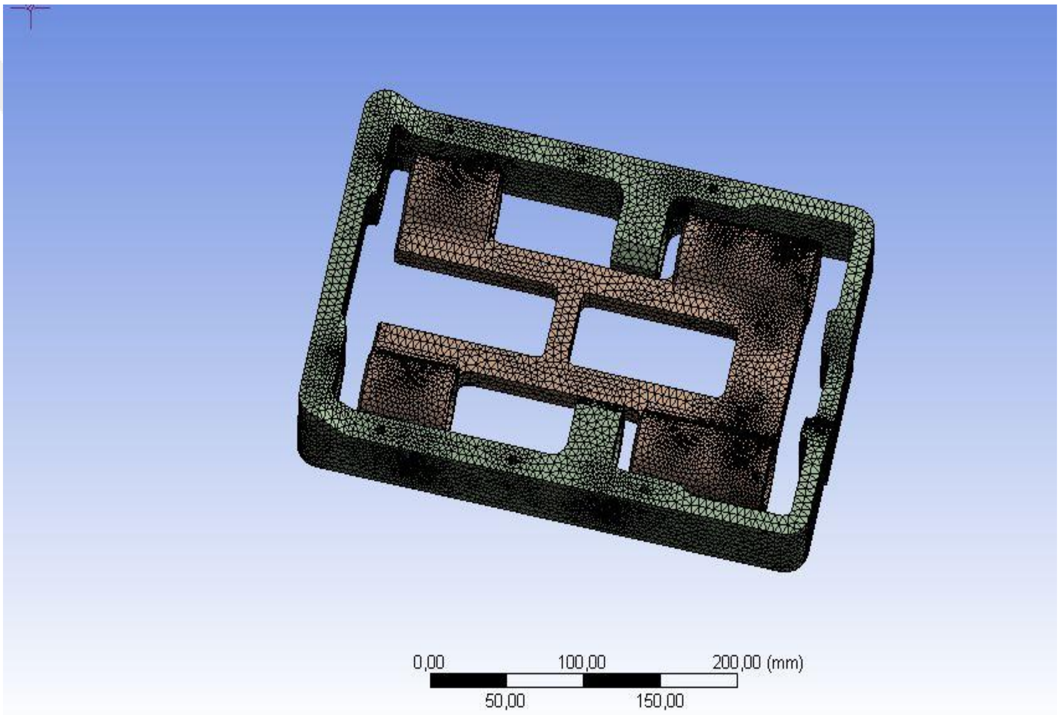

Figure 49 Mesh was Applied, 77110 Nodes and 382292 Elements

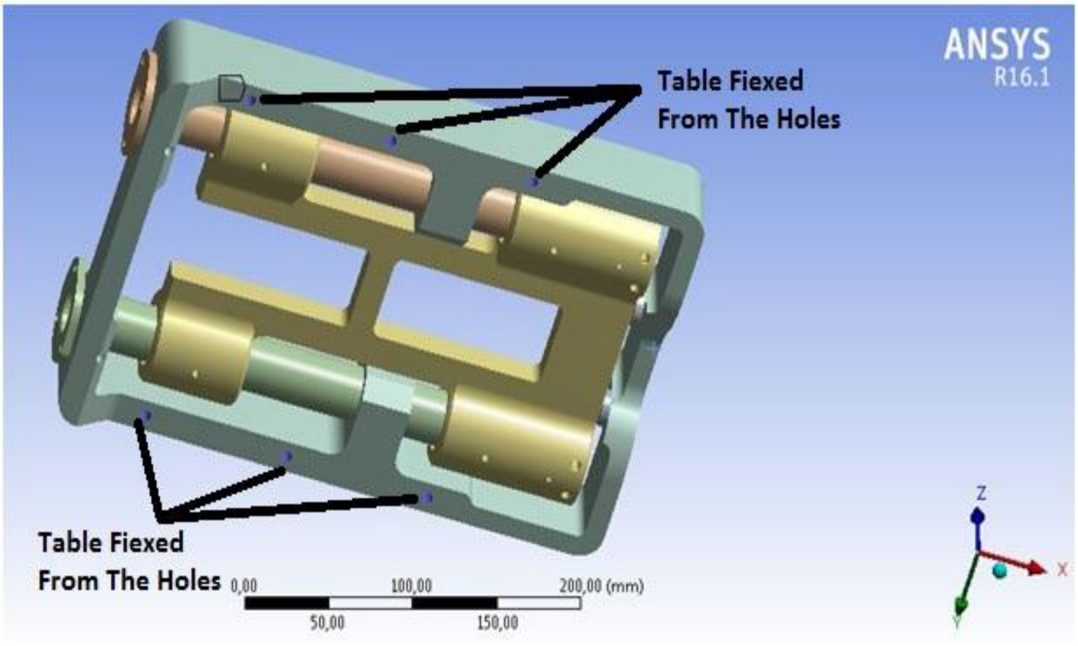

Figure 50 Table Connection Holes On the System

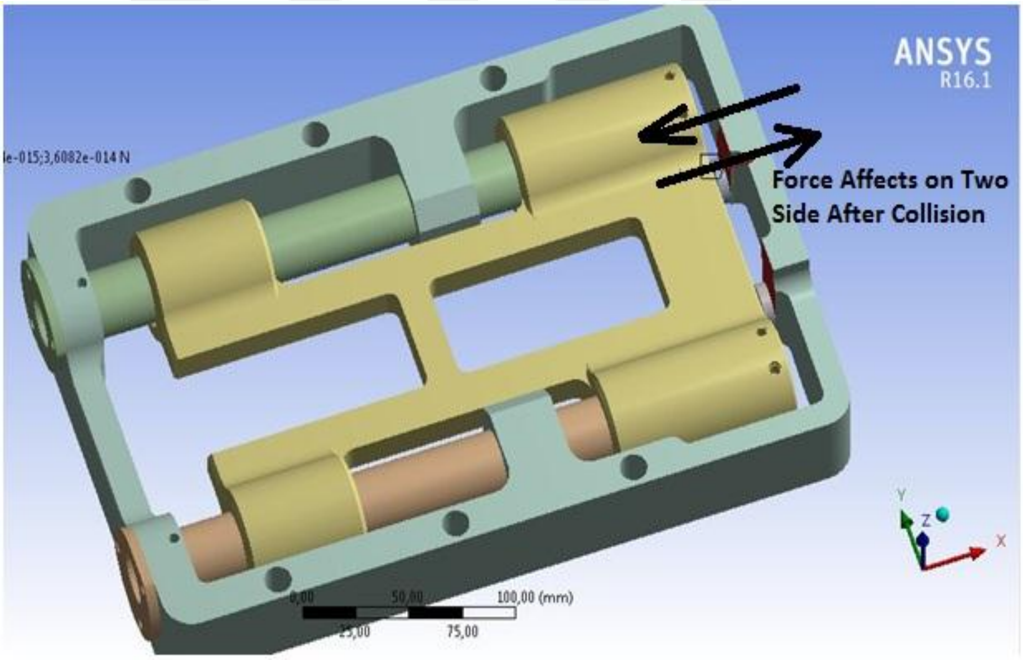

Figure 51 Applied Force Directions

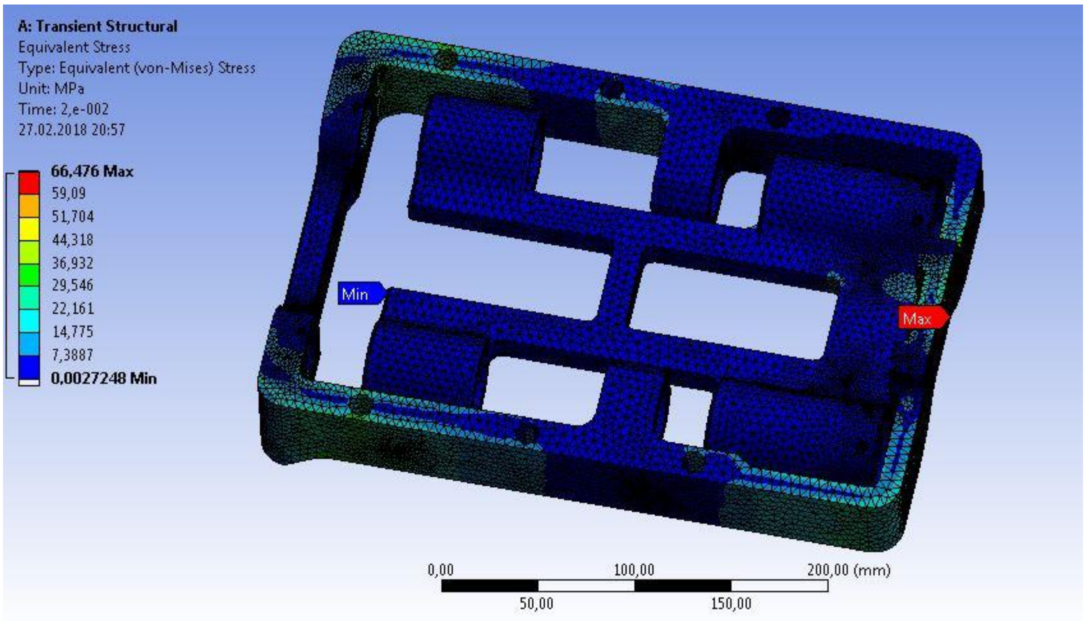

Figure 52 After the Collision Influence on Table in Terms of MPa

CONCLUSION AND RECOMMENDATIONS

It can be argued that the unmannalization in the military area has generally occurred in five stages. These:

1. The use of radio frequency in the guidance of unmanned vehicles,
2. The use of satellite technology in the guidance of unmanned vehicles,
3. The use of laser-guided bombs as a complementary element to unmanned vehicles,
4. In the process of diversification and
5. The use of unmanned systems with full autonomy.

At the beginning of the 1900's, the military field started with primitive models, It began to develop with the German V-1 bomb, which was used during World War II, which has a more bomb-like but qualitatively unmanned structure and is driven by radio frequency. In the following years, although the same radio frequency planes were produced, the frequency of the waves was low and the waves were suddenly cut off. The use of radio frequency can be considered as the first stage in the process of military field detonation.

In the "Space Race" process, which began with the launch of the Sputnik-1 suit by the Soviet Union in 1957, satellite technology was developed and military satellites became available. With the use of GPS technology connected to satellite technology, the dependence of unmanned vehicles on radio frequency has come to an end and thus the operating ranges have increased. The use of satellite technology can be considered as the second stage in the process of military field detonation.

Unbelief that reached a certain level in the 1980s; on-land, accelerating robot investigations and producing unmanned aerial vehicles dedicated to exploration in the air. An example is the various model SRAs used by the US in the 1980s and the 1991 Iraq War. Laser-guided bombs, which proved to be successful at the 2001 Afghanistan and 2003 Iraq operations, used for the first time at the end of the 1990s, have had a complementary effect on unmanned aerial vehicles. The use of laser-guided bomb technology along with unmanned vehicles in the process of humanitarian intervention can be considered as the third stage.

When it comes to 2010 years, Predator, which is a "propeller plane" the model IDHA did not satisfy the states in the process of disinfection. On the land, robots that can walk; in the air, jet-powered unmanned jet planes; the process of producing unmanned systems is accelerated in the sea and under the sea. For example, Bigdog land robots, X-45 and X-47 unmanned jet planes, Piranha model unmanned sea surface vehicle and Sea Stalker model unmanned submarine, which can move in all kinds of lands, are important projects that have matured during this period. Projecting land, sea and submarine vehicles together with unmanned aerial vehicles during the process of humanitarian disaster can be considered as the diversification process or the fourth stage in the process of unmannalization.

In parallel with developing computer technology, systems that are defined as "autonomous" and that can move and decide on a certain scale have begun to be projected. By the year 2030, perhaps, full autonomous systems will be produced. The use of unmanned systems with full autonomy, along with processor technology that develops in the process of human endeavor, can be considered as the fifth and final stage.

The proliferation of military field unmanned maneuvers has affected the military doctrines as well as the way military units are used. The ability of unmanned aerial vehicles to fulfill many "dangerous" missions "successfully" is proof that the future of the air force can be entrusted to unmanned aerial vehicles. Countries will have naval fleet to ensure trade routes and the safety of their coasts. The same task can be accomplished successfully by giving countries the task of unmanned sea and submarine, and the necessity of having human beings in the seas and especially in the submarine can be removed from the helm. The use of unmanned systems on land is a complex issue.

Whether it is civilian or military personnel; people continue their lives on land. The fact that people began to live in cities increasingly with the industrialization process led to the shifting of battlefields to the residential neighborhoods.

Authorizing wheeled or legged autonomous robots, which can be used in cities in the future, to kill people is a moral question mark. The unplanned release of these technologies to the management of large corporations could leave the states with the risk of collapse in the future. It is also a fact that autonomous robots, which can also be used as police, can restrict people's freedom. Unmanned land vehicles, which take the enemy or the terrorist hand, can be seriously dangerous for humans. Therefore, in the future, it seems to be a more logical way to use on-land, autonomous robots, who obey orders and take orders. It is estimated that the use of military and military robots in a hybrid structure, rather than purely autonomous robots, is a more accurate plan from the moral point of view.

In addition to this information, In this thesis, aim is after making the unmanned weapons systems design carry out the selection on the suspension system. In this study, modeling was done in Solidworks, and then our dynamic analysis was carried out in the ANSYS program, we saw with the program that how much repulsive force was exposed on the system. At the same time, a mechanical simulation was applied to make the suspension selection in Matlab software.

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APPENDICES

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