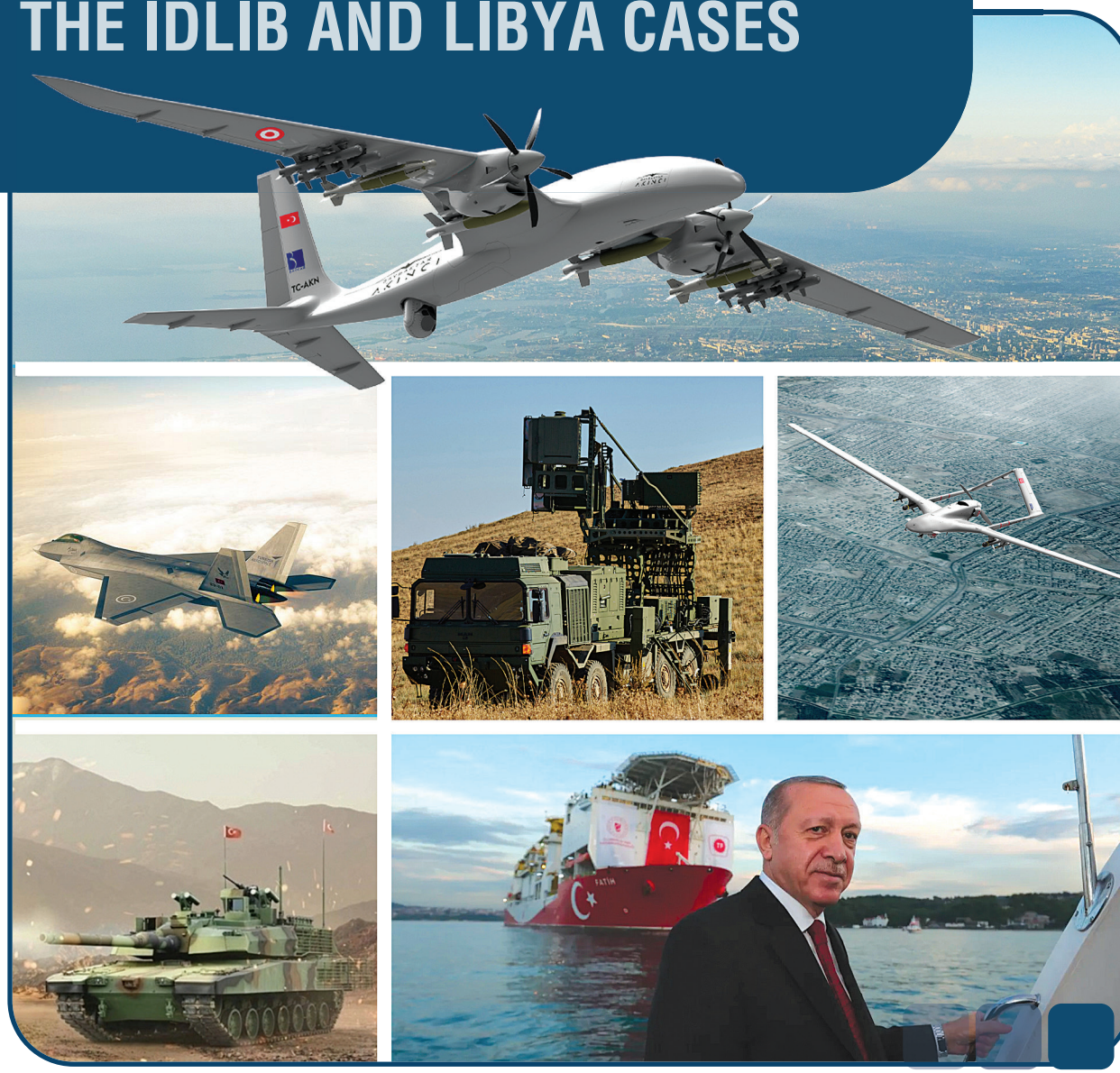
Ortadoğu Araştırmaları Merkezi
ORSAM
مركز دراسات الشرق الأوسط
Center for Middle Eastern Studies

Report

No: 13 / June 2020

TURKEY'S MILITARY TRANSFORMATION: THE IDLIB AND LIBYA CASES



ARDA MEVLÜTOĞLU
S. CANALP KORKMAZ

Copyright

ISBN : 978-605-06764-5-7

Center for Middle Eastern Studies

Adress : Mustafa Kemal Mah. 2128 Sk. No: 3 Çankaya, ANKARA
Phone : +90 850 888 15 20 Faks: +90 312 430 39 48
Email : orsam@orsam.org.tr
Photos : Anadolu Agency (AA)

According to the second paragraph of Article 5 of the Regulation on Banderole Application Procedures and Principles, the use of banderole for this publication is not compulsory.

Ortadoğu Araştırmaları Merkezi
ORSAM مركز دراسات الشرق الأوسط
Center for Middle Eastern Studies

REPORT

TURKEY'S MILITARY TRANSFORMATION: THE IDLIB AND LIBYA CASES

About the Authors

Arda Mevlütoğlu

The author earned his B.A. in space engineering from Istanbul Technical University and M.A. in Science and Technology Policies from the Middle East Technical University. He is currently serving as the Deputy Chairman for Defense Programs for an international trade and consulting company. He has completed various academic studies on defense, aviation, space, and relevant policies as well as on armament and regional power balances and has numerous articles, reports, objects, and interviews published in national and international publications. He speaks English and German.

S. Canalp Korkmaz

The author earned his B.A. in international relations from Selçuk University and his M.A. from the Police Academy in Security Strategies and Administration. Currently, he is pursuing his Ph.D. in the same department. The author has specialized in radicalization, terrorism, and warfare. From March 2016 until June 2019, he worked as a research assistant at the Center for Middle Eastern Studies (ORSAM).

June 2020

Contents

Tables

Introduction

The developments taking place around the borders of Turkey cause security concerns and require Turkey to resort to military options. However, as wars become more complex, battlefields become narrower, and military and civilian populations get closer, involved parties feel obliged to change the weapon systems that they use. The Turkish Army, with its strong commitment to civilian safety in its military campaigns, frequently uses unmanned combat aerial vehicles (UCAV) to prevent collateral damage. Targets are incapacitated either directly by use of UCAVs or by artilleries that work with precise location information obtained through unmanned aerial vehicles (UAV). The most recent examples have been in Idlib where Turkey took a direct side in the war and in Libya where the Turkish Army acts as a consultant.

After the Astana Summit, Idlib became the focal point of regional and global players. The region can almost be described as a brief summary of the 10-year Syrian war. In addition to being a hot war zone, it is populated by foreign terrorist fighters and opposition groups. While Russia wants it to be a 'weapons-free' area so that it can maintain its presence in Latakia, the regime sees it as an area that should be taken over so that the opposition will be weaker during the constitution talks. Therefore, as a place of occasional armed conflict, Idlib is now the epicenter of the Syrian war. The escalating tension in Idlib before and after the Astana talks made an armed conflict almost inevitable. The parties involved, especially Turkey, made great efforts to prevent the tension from turning into an armed conflict and even set up observation posts in the region as a part of the agreements reached during the Astana talks and worked to protect the cease-fire period thought to be guaranteed with the Sochi Agreement.

The predictions that any new tension in Idlib could translate into a new wave of refugees were proven right and, as a result of the increasing air attacks and operations of the regime in spring of 2019, civilians began fleeing Idlib and moved towards the Turkish border. Only in the past year, more than 1 million Syrians left their homes for the Turkish border.

As the observation posts began losing importance and Turkish observation posts were harassed by the regime, the tensions escalated again. When Turkish soldiers were targeted in February 2020 and 34 Turkish soldiers became martyrs, the Turkish military campaign began in Idlib.

The basic goal of the military campaign was to stop the advance of the regime and to ensure the safety of civilians in the region. Therefore, it had been a contained battle. The presence of different players in Idlib has increased the risk of provocation against the Turkish security posts. Furthermore, due to the presence of civilians, the active air defense units and the close proximity of residential areas, firepower was used only in a limited manner.

During the operation, the Turkish Army successfully managed its land and air forces and carried out an exemplary UCAV operation. Turkey successfully completed Operation Spring Shield (BKH) thanks to its national weapon systems, its strong experience in the use of UAV/UCAV, which was gained during its fight against terrorism, and its long-standing experience in coordinating air and land forces, once again due to its long cross-border counter-terrorism operations.

The performance of the Turkish Army during Operation Spring Shield was closely related to the experience gained with Turkish UCAVs in Libya. Thanks to the consulting offered by the Turkish Army in a geography far away from our own, the UCAVs proved very useful despite limited fire support, which became particularly clear after the incapacitation of the Russian

Pantsir self-propelled air-defence systems. In a concept similar to BKH, UCAVs are used in offensive attacks with the help of both electronic attack/electronic support (EA/ES) systems and artillery. This shows that the Turkish Army is moving beyond the usual concept of operations and showed the flexibility to adapt its field experience to new developments. This study examines the onset of the crisis in Idlib, the weapon systems that were used in the subsequent Operation Spring Shield, and the effect of UCAVs regarding the consulting services provided in Libya.

1. The developments that led to the crisis in Idlib

Idlib is the final area in Syria, where armed conflict continues between different players in a fight to weaken the other. This is a hybrid battlefield where armed groups and civilians live together. At the moment, 4 to 5 million civilians live in Idlib which also harbors more than 60,000 armed persons (opposition groups, foreign terrorist fighters, terrorists). Since any conflict can easily turn into a humanitarian crisis in Idlib, involved parties have tried to prevent such conflicts and have sought to solve problems with diplomatic solutions other than military methods. Accordingly, the first step to preventing any conflict in the city was taken during the Astana Talks.

The Astana talks were held in Astana, Kazakhstan on the 23rd and 24th of January 2017. The second meeting was held in February 2017, the third in March 2017 and the fourth one was held in May 2017. During the talks in May 2017, the parties agreed on building non-conflict zones. As a part of this decision, a halt to the military operations in residential areas like Idlib, Latakia, Humus and East Ghouta was intended to allow the entrance of humanitarian aid to the region. However, the cease-fire decision was violated by the regime in all non-conflict zones and thousands of civilians lost their lives as a result.

After the sixth of the Astana talks was held between Russia, Iran, and Turkey to prevent any conflict in Idlib, which has a special status, the parties emphasized their commitment to making Idlib a non-conflict zone. In order to guarantee the maintenance of the cease-fire in Idlib, Turkey, Russia and Iran set up 12, 10 and 7 observation posts, respectively.

With the announcement of the non-conflict zone, in addition to Bashar Assad, terror groups like Hay'at Tahrir al-Sham (HTS) played for time to gain strength and to make up shortages. During this time, the conflicts that took place in and around Idlib were used by the regime as a pretext to intervene in the city. Considering the violations of the cease-fire in the non-conflict zones, it would be very wrong to say that the violations were done only by terror groups or the opposition groups in the region. The cease-fire decision was first violated by the regime, and many times at that, in Dera and East Ghouta. After the regime forces completed their operations in those regions, they turned to Idlib, which was their ultimate target.

The most important development about Idlib took place after the 10th and 11th meetings. During the process of forming the Syrian constitutional committee, the regime, in order to get the region under control, increased the intensity of its attacks on Idlib with the support of the Russian Air Force.

Despite all the decisions, the conflicts in Idlib continued and even occasionally escalated. As a result, President Erdogan and Russian President Vladimir Putin met in Sochi to prevent further escalation of the conflict and to prevent a new refugee wave and signed a new agreement.

On September 17, 2018, the parties signed the Sochi agreement and agreed on building a

Table 1: *Turkish observation posts in Idlib*

Observation post	Date of construction
1st Observation Post	13 October 2017
2nd Observation Post	23 October 2017
3rd Observation Post	19 November 2017
4th Observation Post	5 February 2018
5th Observation Post	9 February 2018
6th Observation Post	15 February 2018
7th Observation Post	17 March 2018
8th Observation Post	3 April 2018
9th Observation Post	7 April 2018
10th Observation Post	9 May 2018
11th Observation Post	14 May 2018
12th Observation Post	16 May 2018

weapons-free zone in Idlib. It was reiterated that, if the tension increased and turned into a bigger conflict in the region, a humanitarian crisis could have ensued. President Erdogan wrote an op-ed for the Wall Street Journal entitled "The World Should Stop Assad" where he explained that the current developments in the city could turn into a disaster.[1]

The parties, by signing the Sochi agreement, intended to ensure the withdrawal of the terror group HTS and other armed groups in the region. However, the plans did not work out and, in addition to the air attacks by the regime, the land offensive against Idlib increased. Within the next couple of months after the signing of the Sochi agreement, the region that once had been cleansed of weapons was targeted by both the regime forces and Russia. As a result, the cease-fire failed and became ineffective.

The regime forces indiscriminately bombed various targets with the use of intelligence from the Russian Air Force and sought to drive people out before entering the area by land to gain complete control. However, despite having deployed its forces near Idlib, the regime had reservations about launching a comprehensive land campaign, knowing that the armed groups in the region could prevent the regime with their rockets and guided antitank rocket systems and cause great casualties. It is also believed that the regime was concerned about its own large casualties if it directly entered the residential areas by land.

The regime attacks on Idlib and its aggravation of Turkish Army checkpoints, prompted the Turkish Army to reinforce its presence in the region. Accordingly, the Turkish Army strengthened its deployment in the region starting in August 2019 and made the checkpoints in the region stronger with new reinforcements.

1.1. The Importance of Idlib for the Parties

With the ongoing conflicts, Idlib becomes tactically and strategically important for the involved parties for different reasons. First, it is the last region where local militants, foreign terrorist fighters, and armed opposition groups remain and fight both each other and the regime forces.

In terms of Turkey, Idlib is important in that it prevents entries and exits to and from the region thanks to Turkish observation posts. Idlib is also very important for Turkey because, if Turkey has maximum control over the Syrian border, it will be difficult for any terror group to gain a foothold in the region. The Amanus Mountains have long been used by the Kurdistan Workers' Party (PKK) terrorist organization to infiltrate Turkey. The Turkish military presence in Idlib plays an important role in keeping the PKK away from the Amanus. However, if the regime obtains control over the area, there is the possibility that PKK terrorists disguised as regime forces can aggravate Turkish soldiers. Indeed, this has already happened quite frequently in residential areas like Tel Rifat and Manbij.

For opposition groups, Idlib is the last region that should be kept under their own control if they want to have a say in the future of Syria. However, if the regime manages to seize control of Idlib, not only will it have a larger area under its control, but also all the regions that Turkey and the Syrian National Army cleared of terrorism and brought peace to for the return of civilians with the Euphrates Shield, Olive Branch and Peace Spring operations, will revert back to their former state of conflict and unrest.

For opposition groups, Idlib is the last region that should be kept under their own control if they want to have a say in the future of Syria.

Furthermore, millions of civilians who will leave Idlib as a result, will put an end to the order and peace established in these regions of Turkish operations. Formerly, the loss of Aleppo had a negative effect on the morale and motivation of the Syrian opposition groups. Already confined in Idlib, if the Syrian opposition loses Idlib, too, it will mean the end of their 10-year long fight against Assad.

For Russia, seizing control of Idlib or pressuring the opposition and armed groups in Idlib is considered important for the safety of Russian units deployed along the Latakia-Tartus line. Even though the cost of keeping boots on the ground is rising every day for Russia, it is strategically important for Russia to have its flag in the military bases along this line. This is because Russian presence in these two locations is significant to hold on to the power obtained in the Middle East and the Eastern Mediterranean. In addition, the fire that broke out on the only aircraft carrier of Russia, the Admiral Kuznetsov, and the fact that Russians do not have an aircraft carrier they can use in distant interest areas, make these bases important for Russia.[2] Furthermore, Russia believes that the elimination of armed opposition in Idlib will strip the group of lands and weaken it in the constitution process.[3]

2. The Changes on the Battlefield and Operation Spring Shield

Throughout thousands of years of human history, wars transformed in tandem with the changes in the world. The most basic factor that changed wars has been technology. Nevertheless, the change was not always about technology: it was also directly affected by politics, society and economy.

Today, the transformation in warfare mostly takes place in three areas: actors, region, and weapons. Now, in addition to regular armies, which are no longer the sole actors in battlefields, non-state actors like private military companies, local insurgent groups, and terror groups have become part of the war. From Operation Euphrates Shield to the Spring Shield Operation, the Turkish Army did not act alone in the war zone but provided both land and air support to the Syrian National Army and deployed its troops in the region.

The spatial change in the battlefield is both a power-related change and a physical one, which led to the beginning of sea and air wars. Today, two new complex warzones are added into the mix: cyberspace and space. Physical battlefields are no longer open, inhabited areas but rather residential areas. Cyberspace is a different dimension of the said physical expansion.

The change in weapon systems increased the capacities of both regular armies and non-state, armed groups. While destructive power increased exponentially, precision, and collateral damage became hot topics, due to the fact that wars are now fought in residential areas.

Cost is another factor in the transformation of warfare. Large battles are now replaced by an impact-oriented operation concept where the goal is the direct destruction of the target by use of special forces. Since the deployment of a large number of soldiers in overseas operations is financially and socially expensive, either proxy players are employed, or swift and result-oriented operations are carried out to achieve intended goals.

Despite all the changes in warzones, one thing remains the same: the power capacity of the states is optimized for ultimate victory. This might sometimes require the unleashing of the entire power available and sometimes the use of a more limited power. The decision that the war will be either strategic, operative, or tactical, changes the tools to be used. Operation Spring Shield (BKH) of Turkey in Idlib is an example. BKH is an example of a tactical-operative campaign, with the depth of the operation, which ranged between 50-100 km into Idlib. In other words, it was a tactical campaign with operational effects.

Today the dichotomy of narrowing/concentrating warzones requires the three factors (actors, places and weapons) to be ready for the said change in question. Although it is necessary to be prepared for the next war zone, considering the hierarchical structures and doctrinal changes of the armies, it is not easy to draw lessons from the past experiences and to prepare for the next war zones and to develop suitable methods.[4] This transformation process, which requires both tactical and strategic changes on a mental and organizational level, can be possible only by knowing about the past, analyzing the present, and predicting the future.

With regards to the war in Syria, regardless of the sides fighting, it is clear that Syria is a hybrid conflict zone. The war is marked by asymmetry in everything; from players to places, power to weapons. This is also evident in the way the involved players develop new operation concepts drawing upon their past experiences. The experiences that the Turkish Army gained in the last 30 years fighting terrorism and its recent experiences through operations in northern Syria are swiftly reflected in its actions in the war zones.

On the other hand, the expanding battlefield increases the need for an efficient, fast and reliable command and control structure. Today the war zones get narrower in terms of time and space. Therefore, fast and reliable command and control gain more importance especially in tactical and operative campaigns.[5] However reliability is just as important. Considering the ongoing war and the balances in Syria, it is crucial that the communication lines are protected from intrusion and attacks so that the command and control process can be efficient. In order to do this, it is necessary to intercept and incapacitate the electronic signals of the hostile forces. Electronic warfare and support systems like Koral and Milkar that were deployed at the border line are important developments in that they show how complex the Turkish army operation is and how different it is compared to its predecessors.

Given the changing structure of warfare, another element that is related to the command and control mechanism is network centric warfare (NCW). In network centric warfare, pictures of the battlefield are taken, sent to the command center where they are analyzed and responded to swiftly as a part of the coordination of the necessary firepower. In addition, visuals provided by UAVs to the command center to be used by the guided missiles carried on F-4E aircraft as well as the visuals of the Idlib airfield taken by E-7T HIK aircraft and their swift analysis, are also procedures carried out as a part of this concept.

Another result of the current transformation in the battlefield is the concept of the fog of war. The concept of the fog of war, which is used to describe the uncertainty regarding the move of the adversary[6]; was used efficiently during BKH, as the parties involved expected the Turkish army to launch a comprehensive land campaign or use jet fighters but instead Turkey used artillery-supported UCAVs. Also the use of E-7T (Peace Eagle) aircraft by the Turkish army, which can be called both a fixed headquarters (on-site headquarters and Ankara) and a flying one, enabled the army to monitor in real-time the developments in the field, to coordinate its efforts accordingly and to swiftly eliminate any uncertainty.

2.1 Operation Spring Shield

On the evening of February 27th, the Russian Federation and the Syrian regime army launched an attack on the Turkish army unit deployed close to Idlib in Northwest Syria. The event resulted in the martyrdom of 34 Turkish soldiers.

Immediately after the incident, the Turkish army launched a campaign against the regime-related militia in Idlib. In this operation called Operation Spring Shield, the Turkish Army intensely used UAVs, artilleries, and its air force. Operation Spring Shield came to an end with the cease-fire agreement signed between Turkey and Russia in Moscow on March 5. From February 27 until March 5, a total of 39 Turkish soldiers became martyrs. According to the data announced by President Recep Tayyip Erdogan, 3400 soldiers were incapacitated, three aircraft, eight helicopters, eight air defense systems, 156 tanks, 108 artilleries, 24 armored vehicles, 49 anti-aircraft trailers, 99 military vehicles and 10 munition storages were destroyed and two military bases were heavily damaged.[7]

2.2 Platforms and Systems Used Most During the Operation

2.2.1 Unmanned Aerial Vehicles

US-made GNAT and I-GNAT type UAVs which were purchased by the Turkish army since the second half of the 1990s, formed the foundation for the infrastructure and the first experiences in the area. After seeing that such

platforms greatly helped in the fight against terrorism, new projects were launched to purchase more of these devices and to produce them domestically in the long term. With the first tender, the Turkish army purchased the Heron-1 operative class UAVs from Israel.

In tandem with the Heron procurement project, a Turkish UAV production project was carried out with the main contractor as TUSAS and the first product was the Anka. The second UAV project was launched for a tactical device, with the main contractor as Baykar Defense. As a result, the TB2 and Karayel were developed respectively by Bayraktar and Vestel Defense. After the 2010s, the number of domestically produced UAVs of Turkey quickly increased, and with the Anka and TB2 gaining the ability to carry weapons, they played important roles in the fight against terrorism.

ANKA-S

As a part of the indigenous Medium Altitude Long Endurance (MALE) Development Project, which started to domestically meet the Turkish Army's intelligence, surveillance and reconnaissance needs, a development contract was signed between TUSAS and the Undersecretariat for Defense Industries (Savunma Sanayii Mustesarligi - SSM). This project is designed to ensure development of an operative class UAV family and its inclusion in the Turkish Army inventory.

The maiden flight of the prototype of the first Anka UAV named Block A, took place on 30.12.2010. With a length of 8 meters and wingspan of 17.3 m, the Anka Block A is equipped with a 155hp engine, and one electro-optic camera as its payload. The Block B version with its synthetic aperture radar (SAR), made its maiden flight on 30.01.2015.

Another Anka Block A prototype was equipped with a ROKETSAN Cirit laser guided rocket and was tested in 2013. So, for the first time Turkey used a domestically produced guided missile from a domestically produced UAV and gained a capability that only a few countries in the world enjoy.

The Anka is still the only UAV of Turkey that fires a guided missile. With the MAM-L and MAM-C guided bombs developed by ROKETSAN, the Anka Block B also gained this ability to carry these weapons. On 07.03.2017, an armed Anka Block B made its maiden flight and completed its first firing tests in April 2018.

The SSM and TUSAS signed an agreement on 25.10.2013 for the Anka-S, which is the model customized to the needs of the Turkish Air Force. The first Anka-S that was developed as a part of the project for ten Anka-S and 12 ground control stations and relevant sub-systems, took flight on 25.09.2016. The first two Anka-S UAVs were delivered to the Turkish Air Force in February 2018. Shortly afterwards, the Anka-S was also customized to carry weapons.[8]

The most important feature of the Anka-S is its Satellite Communications System (SATCOM), through which it can exchange data with a distant ground control station. This allows control of the aircraft and obtaining its intelligence in real time even beyond line of sight (BLOS). This capability also offers a certain degree of protection against electronic jamming that might be attempted on the communication between the base station and the UAV. The maximum takeoff weight of the Anka-S, which can stay in the air up to 24 hours at 30,000 feet, is 1660 kg and the payload capacity is close to 200 kg.[9]

Bayraktar TB2

The Bayraktar TB2 was commissioned by the SSM in 2007 as a part of a project to meet the tactical UAV needs of the Turkish Ground Forces. The Defense Industry Executive Com-

Table 2: *Technical Features of the Bayraktar TB2 and Anka-S*

Producer	Baykar	TUSAŞ
Model	**Bayraktar TB2**	**Anka S**
Maiden Flight	29.04.2014	25.09.2016
Total Length	6.5m (21.4ft)	8.9m (29ft)
Maximum Take-off Weight	630kg (1,389lb)	1,600kg (3,527lb)
Wingspan	12m (39.37ft)	17.3m (56.76ft)
Engine	1 x 100bg Rotax 912iS	1 x 155bg Thielert Centurion 2S or PD170
Service ceiling	6,858m (22,500ft)	7,010m (23,000ft)
Maximum Cruise Speed	130km/saat (70kt)	203km/hour (110kt)
Endurance (hour)	20+	24
Maximum Payload Capacity	100kg (220lb)	230kg (507lb)
Payload	GosHawk II, StarSafire 380 or MX15HD EO camera	MX15HD / CATS / StarSafire 380 EO camera ViaSat or CTech SATCOM IFF, PLS, VHF/UHF relay
Weapons	MAM-L/MAM-C	MAM-L/C, UMTAS, Cirit

mittee (Savunma Sanayii Icra Komitesi - SSIK) decided in January 2010 to acquire two-system UAVs (12 aircraft) from KaleKalıp-Baykar Makina with autonomous taxi and take-off capability.

The first TB2, produced as a part of the contract signed in December 2011, made its maiden flight on 29.04.2011. The deliveries that started in November 2014, were completed in June 2015. In December 2015, the carrying and dropping tests with the MAM-L guided bomb began and, in April 2016, the first test firing was completed with an actual warhead. The TB2 was swiftly put into use in domestic security operations and, after its contributions became apparent, new orders were placed for the Navy, Police Force, and Gendarmerie.[10]

The TB2 as a tactical class combat UAV system consists of an aircraft, a ground control station, ground data terminal, remote image terminal and supporting systems. With a single engine of 100 hp, the Bayraktar TB2 aircraft is 6.5 m long, has a wingspan of 12 m and can operate a maximum of 24 hours at 24 thousand feet. It

can communicate with the ground control station from up to 150 km away (line of sight – LOS). The system can take off with a maximum weight of 630 kg and has fully automatic take-off, landing and cruise modes.[11]

The main mission equipment of the TB2, which has a payload capacity of 150 kg, is its laser designator used to illuminate targets. On each of the wings, there are two weapon stations capable of carrying up to four mini smart munitions.

Qatar was the first foreign buyer of the TB2. With a contract signed in 2018, the Qatar Army ordered six Bayraktar TB2's, three ground control stations and supporting systems. The deliveries were completed in 2019.[12] The Ukraine was the second international buyer and, after the contract signed in early 2019, six TB2's and three ground control stations were delivered to the Ukrainian Air Forces.[13]

2.2.2 Artillery

The Turkish Land Forces have more than 7800 artillery pieces, multiple launch rocket systems and mortars. More than 1000 out of them are self-propelled, 790 are towed, 150 are multiple launch systems, and 5800 are mortars.[14]

T-155 Fırtına

The T-155 Fırtına is an artillery system developed to replace the US-made M44 and M52 self-propelled howitzers. It is mounted on a pallet chassis and has a diameter of 155 mm and 52 caliber barrels. The K9 Thunder system of South Korea was customized by ASELSAN especially in the communication and firing control systems. It can use all NATO-standard 155 mm munition and can be operated by five personnel.

Depending on the munition used, it has a range of 40 km. Weighing 47 tons, the howitzer was produced at the 1st Main Maintenance Center Command at Arifiye.[15] Poyraz munition transfer vehicles were also developed to ensure fast and automatic munition supply to Fırtına howitzers on the battlefield. The Poyraz munition transfer vehicle docks behind the Fırtına howitzer and enables swift supply through an automatic munition loading system.[16]

T-122 Sakarya

An indirect fire support system developed by ROKETSAN, the T-122 Sakarya is a multiple launch rocket system that can make rapid and effective fire impact on the target with its 122 mm diameter rockets. Depending on the rocket type used, it has a maximum effective range of 40 km, and each launcher vehicle has 40 rockets. ROKETSAN also developed the TRG-122 guided rocket, which can be used with the T-122 Sakarya. The TRG-122 has a maximum range of 35km and an INS/GPS guidance system.[17]

T-300 Kasırga

The T-300 Kasırga, which is a customized version of the WS-1 obtained from China in the late 1990's, is a 300 mm diameter, multiple launch rocket system that can carry four TR-300 rockets.[18] ROKETSAN also developed the TRGK-300 guidance system that can be installed on TR-300 rockets and then produced the TRG-300 Kaplan guided artillery rocket. The TR-300 rocket family has a 150 kg warhead and a maximum range of 90 – 100 km.[19]

2.2.3 Electronic Warfare Systems (EW)

In the broadest sense, electronic warfare is the military activities carried out to control the electromagnetic spectrum. Attack (electronic attack) or intelligence-related activities (electronic support) are a part of this concept.

Even though EW includes the military oper-

ations related to the electromagnetic spectrum, it can also have a physical dimension as in the case of directed energy weapons or in hard kill systems.

The similarity of EW to fields such as intelligence (most notably visual intelligence, signal intelligence), cyberwar, command-control, air defense wars, makes it difficult to classify and track the techniques, technologies and systems used in this area.

Electronic attack (EA) refers to the use of the electromagnetic spectrum for an attack on the enemy. This attack can include physical destruction, as in the examples of anti-radar rockets or directed energy weapon systems, but it also can include electronic jamming or deception or temporary or permanent incapacitation by means of cyber-electronic war techniques and systems.

Therefore, we can examine electronic attacks under two groups: hard kill or soft kill. In the hard kill group, the goal is to completely or partially destroy the electromagnetic warfare or weapon systems of the enemy. Close-in weapon systems (CIWS), air defense missiles, active self-defending armored vehicle systems (Trophy, Akkor, Ştora, etc.) can be cited as examples of hard kill systems. Also, anti-radar rockets like AGM-88 HARM, used in the destruction of hostile radars, are also among the hard kill systems.

In the soft kill group, the EW systems of the enemy will not be destroyed but they will either be delayed, or their proper functioning will be prevented. Chaff, flare, decoy, EA systems, and infrared countermeasure systems (IRCM) are examples of soft kill systems.

Jamming, which can be considered a derivative of the soft kill, is the act of preventing the enemy from using the electromagnetic spectrum or causing destruction or deliberate emission or reflection of the same to inflict damage on the enemy systems. In other words, such an act can completely blind the enemy, can prevent the enemy from seeing its own troops or it can cause the enemy to gather wrong intelligence about its own troops.

Electronic support (ES), covers all activities carried out to search, detect, identify and sort electromagnetic transmissions. The basic goal of the electronic support on the battlefield is the early identification and detection of threats. In addition, it is used to provide intelligence for other activities particularly for electronic attacks.

The Turkish Army has various electronics support systems used for land, air and sea operations. Especially in recent years the projects for the development, supply and modernization of these systems have greatly increased. Many different EA and ES systems with different duties were produced by the national defense industry. Naturally, there is not a lot of information about which electronic warfare systems were used for Operation Spring Shield. However, based on the information provided by official authorities on the social media and in the press, it is safe to assume that Koral and REDET were actively used during the operation.[20] [21]

Koral

Developed by ASELSAN as a part of the "Kara SOJ"[22] project started for the Turkish Air Force for its land based electronic warfare needs, this system consists of an electronic support system which is integrated into tactical military vehicles and works on a wide frequency band (Land SOJ ES).

The system is used for the purposes of creating weakness in the detection, identification and tracking abilities of the early warning and air defense radar systems of the enemy. When this is done it will be possible to take advantage of the weakness of the enemy in their command-con-

trol and air defense systems. It will also help the Air Force to complete their attack, defense and support duties in a reduced risk environment.[23]

Therefore, the Kara SOJ ES System detects, identifies and determines the direction of radar emissions while Kara SOJ EA jams, creates diversion and incapacitates target radar systems. A Koral system consists of an electronic support (ES) and four electronic attack (EA) systems. The ES system is a modular system with a 360-degree coverage in long range. It can determine, identify and classify electromagnetic emissions in a wide band range. The multi receiver system can identify the direction and geographical positions of the detected emissions. Designed completely numerically, the Koral ES system can automatically detect identified threats. The Koral ES system also has a modular architecture like the ES component and has an integrated Digital Radio Frequency Memory (DRFM). The indexed sequential EA system has two antennas and has different jamming modes. The EA component also functions as ES.[24]

Radar Electronic Support and Electronic Attack System (REDET)

The REDET system was developed by ASELSAN as a part of the Radar Electronic Support and Electronic Attack System Project started for the Land Forces to meet its land-based long-range EW needs. The system consists of Radar ES and Radar EA components.

Radar ES systems detect, identify and classify hostile radars and collect necessary intelligence for EA and gather information like the frequency, pulse width of hostile radar as well as functioning qualities and record them in its database. The system has a modular design and can perform automatic identification.

Source: *www.aselsan.com.tr*

A radar EA system can perform jamming or confusing EA activities in order to restrict the coverage of other radars or to completely render them ineffective. The system works in tandem with ES systems and can automatically adjust the defense and functioning modes.[25]

The delivery of REDET II systems, which are modernized versions of the original REDET in line with the experience and know-how obtained with the Koral project, was completed by the end of 2019.[26]

2.2.4 Combat Airplanes

The combat aircraft fleet of of the Turkish Air Force consists of US-made F-16C/D Fighting Falcon and F-4E Phantom II fighters. Turkey purchased a total of 236 F-4E and RF-4Es between 1974 - 1994 and 270 F-16C/Ds between 1987 – 2012. Currently, around 240 F-16s and 40 F-4Es are in active service.[27]

F-16 Fighting Falcon

The F-16 is a single-engine, multiple-role combat fighter that made its maiden flight in 1974. Over time, in line with the advancing technology, its performance and skills greatly increased and these new developments were reflected on the models called 'Block'. So far, close to 3600 F16s have been produced for 25 countries, of which the latest model is called Block 70. Its maximum takeoff weight is 19 t and can carry 7.7 t of weapons and duty systems in its 11 chassis and wing stations.

As a part of two projects named Peace Onyx I and II, the Turkish Air Force purchased 240 F-16C/Ds between 1987 - 1999. The Block 40 and Block 50 versions were subjected to an extensive avionic modernization between 2009 and 2015 under the Peace Onyx III program. Close to 35 units of Block 30 aircraft went through a partial structural upgrading and one of them was used as the prototype of the national duty computer and avionic development project.

Thirty units of Block 50+ F16s were bought under the Peace Onyx IV program, in order to compensate for the problems due to accidents and to renew capabilities. The distinctive quality of these aircraft, which were delivered in 2011 and 2012, is their ability to carry a conformal fuel tank over their airframes, at the joint of the wings. This way they need less aerial refueling and can travel further or can stay airborne for longer. Currently, close to 240 F-16C/Ds are active.

F-4E 2020 Terminator

The F-4 Phantom II, developed for the aircraft carriers of the US Navy, had its maiden flight in 1958 and then new orders were placed for the US Air Force. The most common model: the F-4E was frequently used in Vietnam, the Arab – Israeli wars and the Iran-Iraq wars. Five thousand, one hundred and ninety-five units of the Phantom II were produced for 12 countries including the USA. It is the supersonic combat jet fighter produced the most by the USA.

Between 1974 – 1994, a total of 236 F-4Es and Tactical Reconnaissance RF-4Es were delivered to the Turkish Air Force. Fifty-four of them were upgraded by the Israeli Aerospace Industries (IAI) between 2000-2003. The F-4Es, which were equipped with new radar, communication and avionics systems, were also enhanced with the ELM-8222 electronic warfare pod and the Popeye 1 cruise missile carrying capability. As a part of this upgrading process, a system integration laboratory (SIL) was set up at the Eskişehir 1st Air Maintenance Center, which allowed Turkey to update and modify the software and hardware of the aircraft. Thanks to this infrastructural support and the high carrying capacity of the aircraft, the F-4E 2020 also

serves as the test aircraft in the process of developing national weapons and mission systems.28

The 16 F-4E aircraft that were not covered by the Terminator project, but were still operational, received a limited avionics upgrade. Dubbed the F-4E/TM Şimşek, these aircraft were equipped with ASELSAN communication and cruise systems. Under the project between 2009 – 2011, the F-4E/TMs were planned to be in service between 2014 – 2016, but they were pulled out of service earlier, in June 2012.[29]

Turkey's position in the F-35 Joint Strike Fighter project, in which it had been a stakeholder since the third level development stage, was affected by the procurement of the S-400 air defense system.[30] The Turkish Air Force plans to gradually replace F-4E 2020s, which will complete their service lives in early 2020, with F-35As.[31] Turkey plans to purchase a minimum of 100 units of the F-35A. Turkey is also interested in the F-35B short take off- vertical landing (STOVL) model for its multi-purpose amphibious assault ship TCG Anadolu, which is built for the Turkish Navy. However, due to the procurement of the S-400, the US administration removed Turkey from the F-35 project, suspended the delivery of the produced aircraft and halted the training of Turkish personnel in the USA.[32]

2.2.5 Supporting Aircrafts

KC-135R

In the early 1990s, the Turkish Air Force needed aerial refueling aircraft so that the fighters could have a longer range and could stay airborne longer. Accordingly, the US-made KC-135R Stratotanker with the "boom" refueling system, which is suitable for F-4Es and F-16s of the Turkish Air Force was chosen in 1994. Seven surplus aircraft were selected, which were under storage in the USA, and these were extensively repaired and upgraded. Until the time the ordered aircraft were ready for use, two KC-135Rs were leased for operational training and capability building purposes between 1995 and 1997. In 1997 and 1998, a total of seven KC-135Rs entered service and began operations with the 101st fleet of the 10th Tanker Base set up in Adana, İncirlik.

E-7T Peace Eagle

Turkey, in order to monitor the air traffic over a wide area, to detect possible threats from large distances, and to compensate the gaps in coverage area of the radar network resulting from the terrain qualities, launched an airborne early warning and control aircraft procurement project. Although delayed due to economic problems, a deal was signed with American Boeing in 2002 under which it would deliver four E-7 HEIKs which was a customized version of the Boeing 737-700 passenger aircraft. These aircraft, dubbed MESA, are produced by Northrop Grumman, have state-of-the-art technology, and with their MESA radar and electronic intelligence (ELINT) system, can carry out early warning, intelligence gathering, and command-control missions. With deliveries completed between 2014 and 2015, Turkey's airspace and vicinity can now be monitored 24/7, enabling provision of command control and intelligence support to military operations in the region.

Other Intelligence, Reconnaissance and Electronic Warfare Aircraft

Since the second half of the 1990s, the Turkish Army began purchasing aerial intelligence and electronic warfare aircraft platforms for various purposes, most particularly for its fight against terrorism. Some of these aircraft are the C-160 MİlKar-2U, the C-160 Gören, the CN235 MilSis-23U and the King Air 350 İKU.

One C-160 cargo plane of the Air Force was equipped with the MilKar-2U electronic jam-

ming system developed by ASELSAN and began its operations in 1995. The C-160 aircraft were also equipped with an electro-optic camera and data link systems under the Gören project and are now used for imagery intelligence (IMINT) missions.

The CN235-100M lightweight cargo plane equipped with MilSis-23U (ASELSAN) in the late 1990s, has been used since the late 1990s for aerial electronic intelligence (ELINT), communications intelligence (COMINT) and signals intelligence (SIGINT). For real-time IMINT missions and anti-terrorism operations, the Land Forces, Gendarmerie and Police Force purchased various versions of King Air 350 aircraft, equipped with various sensors and communication systems starting in the early 2010s, in order to support UAVs. These manned reconnaissance aircraft can fly over the relevant area for long periods and offer service using their high resolution and laser marking cameras and advanced communication system. They can be equipped with a number of different systems thanks to their large inner space and relatively high carrying capacities.

2.2.6 Air Launched Weapon Systems

The Turkish Air Force made great leaps in precision-guided strike capability especially after the 1980s with the introduction of F16s. After the addition of navigation and targeting pods in the late 1990s, it became possible to achieve precision strikes over long ranges. The production and development capabilities of the national defense industry also allowed the development of unique solutions in this area. Various guidance kits, bombs and missiles used in manned and unmanned aircraft are produced domestically. The benefits of those systems were evident in internal security operations. Similarly, during Operation Spring Shield, domestic precision guided weapon systems played a great role in the success of the operation.

Guidance Kits

The precision of the conventional bombs used by aircraft depends on environmental factors, most notably aerodynamic effects. After they are released from the plane, bombs might deviate from their intended course due to altitude, winds, speed, etc. Due to these deviations, bombs might fall somewhere that is far away from the actual target. Sometimes multiple bombs are dropped so that it will be more likely to hit the target but in this case lots of munition is spent, more aircraft are needed per target, and the associated risks and costs increase.

Thanks to the developments in sensor and electronic systems, bombs and missiles were developed which have course-correction and precise targeting abilities. The cost of developing a new guided missile or bomb can be high compared to the type of the targets for which these weapons will be used. Therefore, any hardware that will increase the precision of conventional weapons, in other words which will make them smarter, are viable options. These devices, which are called guidance kits, highly increase the precision of conventional bombs and dramatically reduce the munition spent per target as well as the number of aircraft and pilots that are put at risk.

The Turkish defense industry, in the past 20 years, has intensely developed and produced precision-guided weapon systems. Many projects were started for the development of guidance kits and the resulting systems were made available to the Turkish Army. The Precise Guidance Kit (Hassas Gudum Kiti - HGK) is the most notable among these systems.

The HGK, developed by TUBITAK SAGE, is installed on conventional gravity bombs to increase their accuracy. The Inertial Navigation System (INS) and Global Positioning System (GPS) are used to generate course correction commands for the moving wings of the bomb to accurately hit the target.

Table 3: *Precision guided bomb systems used by the Turkish Air Force (guidance kits installed used with bombs and guided bombs)*

System Family	Model	Producer	Guidance Type	Weight	Used on
HGK	**HGK-82**	Turkey Developed by: TÜBİTAK SAGE ProducerŞ: ASELSAN	INS/GPS	500 lb Mk82	F-16, F-4E 2020
	HGK-83			1,000 lb Mk83	
	HGK-84			2,000 lb Mk84	
LHGK	**LHGK-84**	Turkey Developed by: TÜBİTAK SAGE ProducerŞ: ASELSAN	Laser + INS/GPS	2,000 lb Mk84	F-16, F-4E 2020
KGK	**KGK-82**	Turkey Developed by: TÜBİTAK SAGE Producer: ASELSAN, Kale Havacılık	INS/GPS	500 lb Mk82	F-16, F-4E 2020
	KGK-83			1,000 lb Mk83	
LGK	**LGK-82**	Turkey Developed by & Producer: ASELSAN	Laser	500 lb Mk82	F-16, F-4E 2020
	LGK-84			2,000lb Mk84	
Miniature Bomb	**MB**	Turkey Developed by & Producer: ASELSAN	INS/GPS	139 kg	F-16
Teber	**Teber-81**	Turkey Developed by & Producer: ROKETSAN	Laser + INS/GPS	250 lb Mk81	F-16
	Teber-82			500lb Mk82	
MAM	**MAM-L**	Turkey Developed by & Producer: ROKETSAN	Laser	22 kg	Anka-S, TB2
	MAM-C			6.5 kg	
HOBOS	**GBU-8**	USA	Laser	2,000 lb Mk84	F-4E 2020
Paveway	**GBU-10**	USA	Laser	2,000 lb Mk84	F-16, F-4E 2020
	GBU-12			500 lb Mk82	
JDAM	**GBU-31[VI]**	USA	INS/GPS	2,000lb Mk84	F-16
	GBU-31[V3]				
	GBU-38			500lb Mk82	
	GBU-54				
JSOW	**AGM-154A-1**	USA	INS/GPS	483 kg	F-16
	AGM-154C		IR + INS/GPS	497 kg	

Table 4: *Guided missile systems used by the Turkish Air Force*

System Family	Model	Producer	Guidance Type	Used on
SLAM-ER	AGM-84K	USA	IR + INS/GPS + command	F-16
Maverick	AGM-65A/B/G	USA	TV / IR	F-16, F-4E 2020
HARM	AGM-88		Radar	F-16
Popeye	Popeye 1	Israel	IR + INS + command	F-4E 2020
SOM	SOM-A	Turkey Developed by: TÜBİTAK SAGE Producer: ROKETSAN	INS/GPS + land reference	F-16, F-4E 2020
	SOM-B1		IR + INS/GPS + land reference	
	SOM-B2			

The HGK, developed by TUBITAK SAGE and which can be installed on Mk84 bombs weighing 2000 lb (close to 907 kg) as well as the penetrating type NEB (Nufuz Edici Bomba) bombs, now have new models suitable for the 1,000 lb MK83 and the 500 lbs Mk82 bombs. Three models that were dubbed the HGK-82, the HGK-83 and the HGK-84, are used by F16 and F4E 2020 fighters of the Turkish Air Force.[33] ASELSAN serially produces these guidance kits.[34]

TÜBİTAK SAGE also added a laser seeker to the HGK-84 and developed the LHGK-84. The addition of the laser seeker helps in attacks against targets with unknown locations and coordinates and/or to protect against GPS signal jamming/confusing attempts.

The Wing Assisted Guidance Kit (KGK) developed by TUBITAK SAGE based on the HGK design, gives 1,000 lb Mk83 and 500 lb Mk82 gravity bombs a gliding ability through an INS/GPS guidance system. With this add-on, the free fall distance and, therefore, the hit range of the bombs greatly increases, allowing accurate hitting from long distances. After being released from the aircraft, wings open and the bomb can achieve accurate hitting of the target from a 100 km range. The accuracy provided by the guidance system is less than 10 m.[35] ASELSAN and Kale Havacılık started serial production KGK, that can be used by the F-16 and the F-4E 2020.[36]

Teber, another guidance system, was developed by ROKETSAN. It can be installed on Mk81 and Mk82 general purpose bombs and have INS/GPS guidance systems and laser seekers.[37] Depending on the altitude from which the bomb was released, Teber has a maximum range of 28 km and has been used by the Turkish Air Force since 2018.[38]

The Turkish Air Force started using laser-guided bombs for the first time with F-4E Phantom II fighters at the end of the 1970s. The GBU-8 HOBOS (Homing Bomb System), GBU-10/12 Paveway I/II laser guided bombs and TV guided AGM-65A/B Maverick missiles and AN/AVQ-23 Pave Spike targeting pods were all included in the inventory of the Turkish Air Force during this time. In subsequent years, along with F-16C/D Fighting Falcon fighters, the number of GBU-10/12 Paveway laser-guided bombs increased. ASELSAN has the license to produce Paveway II laser guided kits and, upon gaining experience and building relevant

infrastructure, it began developing and producing our national laser guidance system (LGK). The company continues to produce LGK-82 for Mk82 bombs and LGK-84 and for Mk84.[39]

Smart Micro Munition

After UAVs proved highly effective in the fight against terrorism and especially with their abilities of detecting and marking the targets, they were equipped with weapons. These aircraft have fixed wings and are smaller and lighter compared to other manned reconnaissance aircraft. Therefore, it became necessary to produce customized munitions for these aircraft with matching dimensions and weight but also with high destructive capacity. In addition, the fact that the fight against terrorism is moving from rural areas to urban areas and the fact that terrorists are now closely situated in with the civilians, it is necessary to opt for munitions that have lower environmental damaging powers, in other words, which destroy only the target but inflict no damage in the vicinity. To this end, ROKETSAN developed the smart micro munition (MAM) and TÜBİTAK SAGE developed the Bozok munition.

Smart micro munition (MAM) is a small sized, precision guided bomb designed to be carried by UAVs and lightweight combat fighters. It has semi-activelaser seekers; the munition has a diameter of 160 mm, is 1 m long and weighs 22 kg. The maximum range is 8 km but with optional INS/GPS guidance systems, can be increased up to 14 km. It can be used with three different types of warhead options; Tandem which is effective against Reactive Armor, High-Explosive Blast Fragmentation, and Thermobaric. These warheads can be used with impact or proximity fuses.[40]

Smaller MAM-C is a version of Cirit laser-guided missile but with the rocket engine removed. With a diameter of 70 mm and length of 970 mm, it weighs 6.5 kg. It can have a range of 8 km and has two different warhead options; multipurpose (Blast Fragmentation, Incendiary and Armor Piercing) and High-Explosive Blast Fragmentation.[41]

Serially produced by ROKETSAN, the MAM-L and MAM-C munitions are extensively used with Anka-S and Bayraktar TB2 UCAVs.

Another guided weapon system that can be carried by UAVs, Bozok was developed by TÜBİTAK SAGE. It has a 16 kg munition laser seeker head and INS systems. It has a range of 9 km. Firing tests with Bozok were carried out at the end of 2018.[42]

Long-Range, Precision-Guided Weapon Systems

The SOM (Stand-Off Missile) developed by TÜBİTAK SAGE, is a cruise missile designed as a high-precision attack system against fixed land and moving sea surface targets, without entering the effective range of hostile air defense systems.

The SOM is a missile family of varying capabilities and has been used by the Turkish Armed Forces since 2011. The 620 kg SOM A and SOM B1 are used against fixed targets, have integrated guidance-controlled missiles that include INS/GPS and a terrain-referenced navigation system.[43] The SOM B2 is the version of SOM B1 with the tandem warhead, effective against Reactive Armor. On the other hand, the SOM C1 and C2, which are currently undergoing the development process, will be used against moving and sea surface targets with the help of the data link system 'Kement' developed by Meteksan.[44] Serially produced by ROKETSAN, the SOM family has another member, which is the SOM-J, being developed to be carried in the internal weapon compartment of F-35 jet fighters and also to be carried by F16s.[45]

As a part of the extensive structural and avionic upgrade of the F-4E Phantom II, the Popeye I air-to-ground precision guided missile system was obtained from Israel.

The Popeye I, which has an electro-optic seeker, INS navigation system and data link for course correction, is a missile with an 80 - 100km range. The image obtained by the electro-optic head is transmitted to the relevant aircraft by means of a data link system and the system on the aircraft makes the fine-tuning of the route as the officer fires the rocket. This substantially increases the accuracy of the missile. The F-4E 2020 aircraft can carry a maximum of two of the missiles that have 350 kg warheads.[46]

The AGM-154 JSOW (Joint Standoff Weapon) carried by F16s that were upgraded under the Peace Onyx III program as well as by F-16 Block 50+s, which were obtained under the Peace Onyx IV program, is a precision guided weapon system that has an infrared seeker and INS/GPS navigation systems. With a range of close to 120 km, after being dropped, the JSOW glides to reach its target. The Turkish Armed Forces use the AGM-154A and the AGM-154C. The AGM-154A-1 are used for soft targets, air-defense and radar systems, while AGM-154C with its projectile warhead, is used against heavily defended hangars and underground premises.

2.2.7 Command – Control and Communication Systems

The efficiency and effectiveness of the elements on the battlefield is directly related to the ability of building and sharing tactical, operative and strategic information in real time. An advanced communication infrastructure is necessary in order to locate and detect the movements and direction of the hostile forces, and to determine the best instruments to be used to incapacitate the target. Furthermore, counter measures and techniques should be carried out so that communication as well as command and control processes are not affected by the electronic intelligence and electronic attack activities of the enemy.

Turkey has made electronic warfare a priority in its defense industry and, especially after the 1990s, has heavily invested in this area. In addition to separate command and control and communication systems aligned with the specific needs of each army group, higher level projects are also carried out for joint organization, planning, organization and data sharing. It is believed that the following systems were used during Operation Spring Shield for command-control and communication purposes:

TAFICS

Started in 1996, TAFICS (Turkish Armed Forces Integrated Communication System) is a communication infrastructure that helps the Turkish Armed Forces to transfer audio, image, video and data swiftly, efficiently and securely. As a part of the project, thousands of kilometers of fiber-optic communication cables were laid across Turkey and various radio connection and communication stations were set up. TAFICS, with its encryption system developed by TUBITAK, uses the X bands of TURKSAT satellites that are assigned to military purposes.[47] Constantly updated and upgraded in terms of capacity and technology, TAFICS plays a great role in helping the newly recruited systems, vehicles and platforms transfer the data and intelligence they obtain to the relevant units in a swift manner.

ADOP 2000

ADOP-2000 is a command-control and communication system that is intended to help the commander make necessary plans to hit the relevant targets in the right time, with the right

weapon systems and munition and also to help the commander to put such plans into practice. In addition, it helps to use fire power with maximum efficiency on the battlefield. It is developed for target detection, command-control of the fire support and automation of technical fire management and to ensure that fire support is planned in line with the other functional fields of the battlefield. It allows the incorporation of Multiple Lauch Rocket System (MLRS), artilleries and mortars as well as their location, identification and tracking system in the automation. It ensures accurate, fast and reliable meteorological and topographic measurements so that firing can be done fast, accurately and efficiently and it transfers the obtained data digitally to other systems.[48]

The Battalion Fire Control System, one of the most fundamental elements of ADOP-2000, is a technical fire management and communication system developed to help field artillery swiftly hit the determined target at the first go and includes command, fire management and communication elements at the battalion level. Developed by ASELSAN, it allows direct support and a general support artillery battalions to carry out their duties in a faster and more accurate manner and also allows them to be included in the digital automation system in harmony with other fire support units and elements.[49]

2.3 Libyan Civil War and the Impact of UCAVs

The Turkish UCAVS had an important effect on the balance of power and the course of the armed conflict in Libya and contributed to the resulting operative and strategic outcomes. Therefore, it will be helpful to examine how the use of UCAVs in Libya affected the civil war in order to be better able to understand the performance and transformation created by the Turkish Army with Operation Spring Shield.

After the ousting of Moammar Gaddafi in Libya in 2011, conflicts in the country kept escalating and turned into a full-fledged civil war by 2014. The main sides to the ongoing conflicts are the Government of National Accord (GNA) recognized by the United Nations and the Libyan National Army (LNA) led by General Khalifa Haftar. Haftar had an important role in the army during the rule of the later ousted Gaddafi and currently receives significant military, technical and financial support from the UAE, Egypt, Saudi Arabia, Russia and France.

Using this support, the LNA made important achievements against the GNA during 2018 and 2019 and most recently, laid siege to the city of Tripoli and took control of important strategic roads and locations. The Grand National Assembly of Turkey, on January 2, 2020, approved a mandate to send troops to Libya. However, due to the situation in Idlib and the subsequent Operation Spring Shield, Syria took priority. Nevertheless, especially after mid-March, armed conflicts in Libya kept escalating.

Videos, images, and information available in open sources reveal that during this time LNA targets and especially LNA supply lines were hit. Although the Turkish authorities did not make any official statements or share any information about this, Bayraktar TB2 UCAVs were intensely used in those attacks. Indeed, many video and images were shared on social media showing how the LNA's armored vehicles, locations and air defense systems were hit by TB2s. The LNA, for propaganda purposes, shared the images of the debris of the TB2s that were shot down or that crashed due to technical problems.

The milestone in this new era, which culminated in the end of the Tripoli siege, was the capture of Vatiyye Airbase by the GNA. Many images were shared showing how Pantsir S1 air defense systems provided by the UAE to the LNA were hit by TB2s. According to some of those images, Pantsir S1 radars had been active.

Increased use of TB2 UCAVs, tipped the power balance in favor of the GNA and forced the LNA forces to retreat.[50] All of these developments made Libya the scene of the most intense use of UAVs and UCAVs in modern military history. The UAE and Egypt, which support the LNA, use Chinese-made Wing Loong UCAVs and provide intelligence and air attack support to the Haftar militia. According to open sources, Wing Loongs used by UAE troops are stationed at el-Hadim airbase in East Libya.[51]

Another interesting detail during this time was how the Pantsir S1 air-defense systems were hit by TB2s. Pantsir S1 low-altitude air defense systems provided to the LNA by the UAE, were installed on German MAN Sx45 8*8 trucks. However, images shared on open sources show that Pantsirs installed on Russian KAMAZ-6560 trucks were also hit.[52] It is believed that these are systems provided from Russian army stocks to the private company named Wagner. It is a known fact that Wagner fights alongside the LNA, as a part of Russian support to Haftar. Most of the Wagner company staff are people that either worked in the past or are still active Russian Army or Russian intelligence members. Therefore, the operators of the Pantsir systems of Wagner must be either current or former Russian Air Force staff. This leads to the conclusion that the weak performance of the Pantsir air-defense system against the Turkish UCAVs was not solely due to the lack of experience or training of their operators. Although it is true that lack of skilled staff is definitely a problem, it is also clear that the usage manner of the UCAVs, especially the way they were used together with electronic warfare and human intelligence, allowed it to inflict great damage in a sustainable manner to the hostile air defense amidst hostile elements and maneuvers, despite some losses. Indeed, thanks to the effect of the UCAVs, Wagner forces had to withdraw from Tripoli and Tarhuna.[53]

In conclusion, the UCAVs significantly tipped the balance of power in the Libyan civil war in favor of the GNA. It is now more difficult for the LNA to preserve its former support after sustaining such losses and retreating. The GNA's successes, and especially the end of the Tripoli siege, allowed it to gain the political upper hand and move from a defensive position to an offensive one.[54]

"The UCAVs significantly tipped the balance of power in the Libyan civil war in favor of the GNA. It is now more difficult for the LNA to preserve its former support after sustaining such losses and retreating."

2.4 The Way the Systems are Used

During Operation Spring Shield, armed unmanned drones, artilleries, precise guidance attack capabilities of the Air Force and the simultaneous use of electronic warfare were especially important in displaying the skills and power of the Turkish Army. The Turkish Armed Forces were able to inflict heavy damage on the Syrian Army in a short period of time, by using artilleries and simultaneous use of artillery and electronic warfare methods.

Air-launched guided bombs were first used during the Vietnam war and once again began to be intensely used after the Gulf War of 1991. Unmanned aircraft were first tested on the battlefield during the Vietnam war and then were heavily used during the Arab-Israel wars of 1973 and 1982.

Combat UAVs have been widely used since 2001. However, electronic warfare has already been widely used in various forms and methods since the early 20th century. In other words, these systems that Turkey used during the operation are not new inventions. However, the way they were used is a first instance in the history of modern warfare.

The most distinctive quality of the Spring Shield operation is that the land forces did not stage a maneuver warfare, but instead efficiently destroyed predetermined targets through air attacks and artillery fire. As a result, tactical outcomes that contributed to the strategy were achieved.

The region of the operation was limited to the city of Idlib and its vicinity. The Turkish Army, the Syrian regime army and their militia, the Syrian National Army (SNA), and other opposition groups and Russian units were all packed in this small area. The region is also under the threat of the air-defense systems of the Syrian Air Forces. There are also aircraft and helicopters of the Syrian and Russian Air Forces as well as those of the US and Israeli forces. Therefore, the operation field of the Spring Shield operation was an extremely difficult one where a tactical scene could change in an instant, where friend and foe could be easily confused, and where the real-time production, distribution and use of battlefield intelligence was extremely important.

In addition, most of the military units and vehicles were stationed either very close to the residential areas or huddled together. In many cases, armored vehicles and artilleries of the Syrian Army were camouflaged in the driveways or gardens of houses. This situation greatly increased the necessity of positive target intelligence. Humanitarian and political responsibility and international pressure that would result from a civilian casualty would be much higher compared to previous campaigns.

In addition to the role and responsibility of Russia in the attack staged against the Turkish Army on February 27, the Turkish Army and the Russian Army frequently engaged during the operation, which created the risk of a diplomatic crisis between the two countries. That could have been a development that would affect Turkey's position in Syria. For this reason, it is crucial that the target intelligence and the firings are planned and carried out extremely carefully and fastidiously. Similarly, there is the risk of Russia engaging the Turkish Army through its air-defense systems and electronic warfare for the purpose of pressuring Turkey or to limit Turkey's advantage in Syria.

These were the main restricting factors in Operation Spring Shield. Despite such challenging circumstances, Turkey aimed to punish the Syrian regime both for its February 27 attack and Idlib attacks with its high-speed, high-precision firings and to maintain the current political process by ensuring the security in and around Idlib.

2.4.1 Unmanned Aerial Vehicles

One of the most important qualities of UAVs in their reconnaissance, surveillance and intelligence gathering missions, is their ability to remain airborne for a very long time over target areas. UAVs can remain in the area for 12 to 18 hours and longer and help gain persistent and real-time intelligence over the target area. This way, tactical, operative or strategic real-time intelligence is built and updated.

Having UAVs constantly in the air during the Spring Peace, Olive Branch and Euphrates Shield operations of Turkey in Syria was normal and expected. This is so because the information and intelligence gathered by those platforms were critical for the safety and the early determination of risks in the field. However, in Operation Spring Shield, Turkey added another

layer to the standard use of UAVs and constantly kept dozens of UAVs in Idlib's airfield. There is no other example of such use of UAVs and UCAVs in military history.

UAVs which carried out too many tasks in such a confined area, were tasked with three missions. These can be summarized as follows:

First, UAVs identified and designated targets for combat aircraft and artillery strikes. This is one of the oldest missions of the UAVs. The laser target designators of the electro-optic cameras of UAVs accurately determine the coordinates of the target and transmit the data over data link to the relevant Turkish Army artillery unit or fighter aircraft. This way, targets can be hit in real-time with great precision. In other words, UAVs and UCAVs were used as a sort of forward observer for artillery and air force.

Secondly, UCAVs, with the smart munition that they carry, attacked the targets with great precision. Anka-S and Bayraktar TB2 UCAVs, using MAM-L and MAM-C guided-bombs, hit fixed and moving targets of the Syrian Army like tanks, armored vehicles, artilleries, MLRS, air-defense systems as well as outposts, depots and warehouses. The munitions used were small in size and inflicted damage only on the targets with minimum collateral damage. Even though they do not completely destroy a tank or an armored vehicle, they render them useless due to damage inflicted. With their compact sizes, they offer ease of access to targets inside and in the vicinity of residential areas. In other words, during Operation Spring Shield, UAVs were used as a sort of "mobile airborne artillery'.

Thirdly, UAVs played a vital role in the tactical, operative and strategic level reconnaissance and intelligence collection processes of the Turkish Armed Forces. UAVs were frequently used to collect images, to designate and determine targets for electronic intelligence and for damage assessment after attacks.

During the operation, UCAVs were used to eliminate many high-ranking Syrian officials. These losses inflicted on the Syrian Army restricted the maneuvering activities of the Syrian regime units in the field and distracted the harmony between the regime and its militia. This outcome was possible by means of human intelligence from the field and using the intelligence in a very swift manner. In addition, the reduction of sensor-to-shooter duration proved very effective. This performance in the elimination of the opportunity targets is a result of the investments made by the Turkish Armed Forces in the command-control and communication infrastructures.

However, this operation also reveals the weaknesses of the UAVs against air-defense systems. Even though some of the relatively developed low altitude air defense systems of the Syrian Army (like the Pantsir) were destroyed, Turkey also lost some of its TB2s and Anka-Ss. Clearly, if the enemy had a stronger air-defense system including better early detection, command and control networks and more trained and qualified staff, Turkey would have lost more UAVs. This weakness of the UAVs is due to their relatively low maneuvering capabilities and their limited payload capacity. However, if they are equipped with self-defense and electronic warfare systems against air defense systems, they will be heavier and bigger.

2.4.2 Electronic Warfare

There is no doubt that the impressive success achieved in such a small area with a high level of enemy threat was mostly due to the synchronous use of UAVs/UCAVs, artillery and air force systems with electronic warfare systems. Naturally, there is no detailed information available about the methods and tactics as well as the systems and instruments used during the operation. However, considering the loss inflicted on the Syrian Army and the Russian elements on

the battlefield, and the quality and quantity of the destroyed targets (like air defense systems), it is safe to conclude that air and land forces were used in tandem with the electronic warfare systems.

Electronic warfare is not only electromagnetic emissions carried out to prevent an enemy from benefiting from the electromagnetic spectrum. It also requires Emission Control (EMCON) in order to prevent the enemy from determining and detecting our capabilities and skills. If this is not done, the enemy will be able to access the working principles and performance of our strategically important systems like Koral and REDET. Therefore, a successful outcome depends not only the synchronous management of various elements but also on a high level of planning and execution control.

Another highlight of this operation was the real time data sharing skills of the elements on the field. From marines to tanks and from battleships to cargo planes, all elements acted like the different organs of a single body using the data communication systems they had. Such a capability turns both friends and hostile elements into separate sensors, and, thanks to the real-time sharing of the collected data, effective firepower can be focused on the desired target at the desired moment. Combat airplanes that fly in formation with UCAVs will act as the tip of the sword in such an organization. The successful implementation of this system and its maintenance, despite the presence of an air-defense system and cyberwarfare threats, was observed on a micro-scale during Operation Spring Shield.

It should be remembered that the dynamic conditions of the battlefield exceed the limitations and capacities of the platforms that are designed only for specific duties. Almost all systems and platforms should be capable of being adapted to different missions. For combat planes this means being able to swiftly switch between different missions during battle like switching from air to air combat to attack on ground targets or to surveillance and intelligence missions. A plane that takes off to attack a ground target can also be required to share the data gathered in real time with friendly elements. Therefore, the fact that UCAVs, electronic warfare or combat fighters can be adapted to different roles in line with the course of the military operations, is a force multiplier.

2.4.3 Fire Support Elements

During Operation Spring Shield, artillery units were used almost as intensely as the UCAVs and the intelligence gathered regarding the target were constantly sent to the fire support elements, allowing opportunity targets to be eliminated. Barreled and non-barreled artilleries were intensely fired to create fire pressure on the mobile elements of the Syrian Army and to start battalion fire on the Syrian artillery. Swift and effective use of artillery in synchronization with UCAVs became possible thanks to ADOP-2000. This is also how it became possible to share timely intelligence about the target and information about environmental conditions and to start firing at the target within an automated system.

However, it should also be noted that the Turkish land artillery units, despite this high performance and their skills, still do not have guided artillery missiles and rockets. Artillery units are crucial with their immediate and high precision fire support particularly during counter-terrorism operations. This skill becomes even more important in an asymmetrical battlefield that is close to residential areas. Guided artillery munition creates a huge difference on a battlefield with its swift and high precision fire support. However, the sole guided artillery missile that Turkey has is the INS/GPS guided artillery missile. The usefulness of this system on a battlefield where there will likely be a high

amount of GPS jamming, is highly dubious. Laser guidance, which is widely preferred for artillery missiles and artillery rockets, and even newer guidance kits that are being developed, will no doubt, greatly help in this area.

Air Force

The Turkish Air Force gained solid experience during its domestic and cross-border operations that it carried out as a part of its fight against terrorism in the last 40 years. As a result, it has a notable infrastructure in near air support and the use of guided munitions sensitive to ground targets. During Operation Spring Shield, this experience was effectively used against hostile air-defense systems in a stand-off manner.

Also, as seen in the hitting of two Su-24 and one L-39 jet fighters of the Syrian Air Force from a long range, when coordinated by airborne early warning and control (HEIK) aircraft and supported by tanker aircraft, the Turkish Air

Table 5: *Air-defense systems destroyed, and aircraft shot down by the Turkish Air Force during Operation Spring Shield*[55]

Shot Platform	Type	Date
1 x Buk (SA-17 "Grizzly")	Air-defense system	27 February 2020
1 x Pantsir S1 (SA-22 "Greyhound")	Air-defense system	27 February 2020
2 x Buk (SA-17 "Grizzly")	Air-defense system	1 March 2020
1 x Pantsir S1 (SA-22 "Greyhound")	Air-defense system	1 March 2020
2 x Su-24 ("Fencer")	Jet fighter	1 March 2020
1 x Pantsir S1 (SA-22 "Greyhound")	Jet fighter	2 March 2020
1 x L-39 Albatross	Jet fighter	3 March 2020

Table 6: *List of Turkish UAV/UCAVs losses* [56]

Shot system	Date	Place	Shot by
Anka-S	25 February 2020	Idlib	Pantsir-S1
Anka-S	29 February 2020	Idlib	Pantsir-S1
Anka-S	29 February 2020	Idlib	Pantsir-S1
Anka-S	1 March 2020	Serakib	MANPADS[1]
Bayraktar TB2	2 March 2020	Idlib	---
Anka-S	3 March 2020	Serakib	MANPADS
Bayraktar TB2	3 March 2020	Idlib	---
Anka-S	4 March 2020	Idlib	---

[1]***Manpads: Man Portable Air Defence System***

Force can gain air supremacy, ensure stand-off control and provide an effective air protection umbrella to friendly elements on ground. This ability to gain and maintain air supremacy in tandem with E7T HEIK and other electronic warfare elements, is a skill only a few NATO members have.

Intense use of UCAVs in Idlib made the costs far more tolerable. Because there is a great difference in the cost of a UCAV and a jet fighter. The cost of losing a jet fighter is close to US$100 million which goes even higher considering the costs of modernization, upgrading, and the associated pilot-training. However, since Turkey has a defense industry that can replace every lost UAV/UCAV with a new one, it was able to use UAV/UCAV flexibly and comfortably in Idlib.

Conclusion:

Our thoughts regarding the role of the Turkish Army as a belligerent in Idlib and as a consultant in Libya, are as follows:

- Despite the difference in the roles Turkey played in Idlib and Libya, the EA/ES systems recently developed by Turkey, as well as its artillery units and involving the use of UCAVs at the tactical level , allowed the Turkish Army to obtain fast results. Following the attack on Turkish soldiers in Idlib, the Turkish Air Force launched an air campaign surprisingly using its UAVs, instead of using its jet fighters as expected of it. The destruction of both low altitude and medium altitude air defense systems by tactical class UAVs will lead to the development of radar and electronic warfare systems for future wars.
- The fact that, during the operation, the Turkish Army destroyed not only the belligerent elements but also the bases and warehouses, shows that the operation was not only a tactical one but also a strategic one intended to prevent a repeat of the actions of the enemy forces.
- The targeting of the air defense systems of the enemy forces shows that Syrian aircraft cannot fly without the protection of Russia. The fact that a Turkish F-16 shot the regime planes in only a couple of minutes of entry-exit to the air-space of Idlib shows that the regime planes can easily be destroyed in a similar event. It is believed that new systems will be deployed in the region due to the losses sustained by the regime. However, if this happens the border with Israel will run the risk of getting weaker. This will not be acceptable by the Iran-backed Shia militia, which is occasionally targeted by the Israeli Air Force.
- The fact that Turkey is close to the area of conflict and has the capacity to provide ground logistics support to its units without having any military obstacles in between, allowed Turkey to make great achievements in its military operations from the Euphrates Shield to the Spring Shield operations.
- Starting with the Euphrates Shield operation and in tandem with the shifts in power balance in the Post-Cold War world, Turkey gained significant experience on squad, battalion, regiment and brigade levels.
- Following the plane crisis of November 2015, Russia deployed its S-400 air-defense systems and completely closed the Syrian airspace to Turkey. However, with Operation Spring Shield in Idlib, Turkey showed that it can easily get around this obstacle using its tactical class, high capacity Bayraktar TB2 and ANKA-S, without having to use its jet fighters, the F16s and F4Es.
- The operation in Idlib, due to the limited space and the presence of different military parties on the battlefield, was a tactical-operative campaign. But in terms of its

outcomes, it became a strategic war. This played a role in the selection of the weapons and systems that were used. With its discipline and proficiency, the Turkish Army developed a unique concept of operation for Idlib and used its tactical-level armed and reconnaissance UAVs in a different manner than before and became greatly successful as a result.

- The destruction of hostile elements by fire support units of different military departments of the Turkish Army during Operation Spring Shield in Idlib, made this campaign a joint military operation.
- The deployment of fire support elements along the border and close to the border enabled the supply line to operate without any interruptions and maximized the security of the stationed units. This also shows how much the Turkish Army trusts in its fire power range and precision.
- Necessary units from different departments were sent to the battlefield as required by changing conditions and firepower was used in the most efficient manner.
- In today's changed warfare landscape, another war is fought in the media. There is an intense propaganda and disinformation effort against Turkey both in print and social media. Particularly the Russian rhetoric against Turkey, spread through Sputnik, was important. However, Turkey's ability to counter such propaganda and to support the facts with fast provision of field data and images to the national and international media, shows Turkey's proficiency increased since Operation Euphrates Shield.
- The operational experience that Turkey gained in Idlib is useful not only for Turkey. Turkey has been a member of NATO since 1952, and, considering its contributions to NATO, its experience is noteworthy.
- During Operation Spring Shield, which took place on a conventional battlefield, Turkey successfully employed UAVs/UCAVs and electronic warfare systems like KORAL and MILKAR against advanced air-defense systems as a part of its concept of operations.
- It became clear one more time that, in a confined battlefield where different belligerent sides are present, like in Idlib, having the advanced command-control systems was crucial.
- It was seen that, when UCAVs and artillery units are supported by electronic and imagery intelligence, they can easily gain the upper hand over hostile mechanized and artillery units. Especially tanks and armored vehicles will be defenseless against UCAVs.
- Thanks to the air umbrella provided by air defense systems and combat fighters, and with the help of electronic warfare systems, the UCAVs carried out a speedy and efficient attack.
- For the new concepts that are put into practice in the battlefield, training and device-related feedback is also required. The UAVs lost in the operation should be thought of as contributions to future improvements, which will prevent any similar problems in a more complex operational scene.
- UAVs marked the targets and acted as reconnaissance helpers for F-4 and F-16 guided missiles and bombs. However, sometimes UAVs directly acted as combatants.
- Many high-ranking Syrian officials were eliminated by UCAVs, which was possible by means of synchronization of the on-site human intelligence and UCAVs and the speed of the decision-making process. The effect of locating and tracking and destroying highly important targets, and simultaneous use of human, electronic intelligence

and electronic attack facilities, were clearly seen during the operation.

- It became evident that the regime forces did not have the capacity to engage in any conflict or have the capacity to maintain the current ones without the support of the Russian Federation.
- The Syrian and Libyan cases one more time showed the importance of logistical support and proximity on the battlefield even when parties are not directly fighting but offer consulting services instead.
- With every new campaign, Turkey gains new experience and uses it in its subsequent operations. Prior to the failed coup attempt of FETO on July 15, 2016, the army had weakened and slowed down due to the plots of the FETO terrorist groups that had infiltrated the army. But now all those flaws are corrected, capabilities are regained, and the results are displayed clearly on the battlefield. Discharging of FETO members from the Turkish Armed Forces is making the Turkish Armed Forces stronger every day on the battlefield.

Endnotes

1 https://www.wsj.com/articles/the-world-must-stop-assad-1536614148 (Access Date: 28.03.2020)

2 https://www.bloomberg.com/news/articles/2019-12-12/russia-s-only-aircraft-carrier-stricken-by-fire-in-latest-mishap (Access Date: 21.03.2020)

3 Kutluhan Görücü, "İdlib'e Farklı Bakmak: Sünni Nüfus Eritiliyor", Suriye Gündemi (Erişim Tarihi: 01.04.2020) http://www.suriyegundemi.com/2020/02/04/idlibe-farkli-bakmak-sunni-nufus-eritiliyor/

4 Ben Barry, (2017), Learning Under Fire: Military Adaptation, Adelphi Series, Vol. 56 Issue: 461, s. 111-112

5 Geleceğin Muharebe Sahası, (1991), Kara Harp Okulu: Bilgi Toplama ve Yayım Merkezi Yayınları, S. 9

6 Mehmet Tanju Akad, 2011, Modern Savaşın Temel Kavramları, Kitap Yayınevi: İstanbul, S. 51

7 "Son Dakika... Cumhurbaşkanı Erdoğan'dan Yunanistan'a Çağrı: Sen De Kapılarını Aç", Milliyet, 08.03.2020: https://www.milliyet.com.tr/siyaset/son-dakika-cumhurbaskani-erdogandan-yunanistana-cagri-sen-de-kapilarini-ac-6161126

8 İbrahim Sünnetçi, " Türkiye'de Hizmetteki İHA Sistemlerine Bir Bakış-2", Savunma ve Havacılık, No: 170, S.85

9 "Anka-S'de İlk Sipariş Başarıyla Tamamlandı", Anadolu Ajansı, 11.01.2019, Https://www.Aa.Com.Tr/Tr/Turkiye/Anka-Sde-İlk-Siparis-Basariyla-Tamamlandi/1361875

10 İbrahim Sünnetçi, "Türkiye'de Hizmetteki İHA Sistemlerine Bir Bakış-2", Savunma ve Havacılık, No: 170, S.85

11 Bayraktar Tb2, Baykar Savunma, https://www.baykarsavunma.com/iha-15.html

12 "Bayraktar Tb2'ye İlk İhracat Sözleşmesi", C4defence, 14.03.2018, https://www.c4defence.com/arsiv/bayraktar-tb2-ye-ilk-ihracat-sozlesmesi/5882/1

13 Ahmet Alemdar, "Ukrayna'ya İhraç Edilen Bayraktar Tb2 Siha'lar Kabul Testlerini Başarıyla Tamamladı", Defenceturk, 09.11.2019, https://www.defenceturk.net/ukraynaya-ihrac-edilen-bayraktar-tb2-sihalar-kabul-testlerini-basariyla-tamamladi

14 "Chapter Four: Europe", The Military Balance 2020, International Institute for Strategic Studies, 2020, S.154

15 "T-155 Fırtına", Asfat, https://www.asfat.com.tr/t-155-k-m-obus-firtina/

16 "Poyraz Mühimmat Aracı", Asfat, https://www.asfat.com.tr/poyraz/

17 "122 mm Çok Namlulu Roketatar Sistemi", Roketsan, Https://Www.Roketsan.Com.Tr/Urun/T-122-Cnra-122-Mm-Cok-Namlulu-Roketatar-Sistemi/

[18] Sıtkı Egeli, «Turkey Nin Balistik Füze Programı", Ortadoğu Analiz Ekim 2013, Cilt 5, Sayı 58, S.31

[19] "Trg-300 Kaplan Füzesi", Roketsan, https://www.roketsan.com.tr/urun/trg-300-kaplan-fuzesi/

[20] Ayşe Böcüoğlu Bodur, "Bakan Varank Uzman Mühendisleri 'Sıcak Bölge'ye Taşıdı", Anadolu Ajansı, 02.03.2020, https://www.aa.com.tr/tr/bahar-kalkani-harekati/bakan-varank-uzman-muhendisleri-sicak-bolgeye-tasidi/1751650

[21] " Türkiye'nin Dengeleri Değiştiren 'Akıllı' Güçleri", TRT Haber, 05.03.2020, https://www.trthaber.com/haber/gundem/turkiyenin-dengeleri-degistiren-akilli-gucleri-464984.html

[22] Soj: Stand Off Jammer: Uzak Mesafeden, Menzil Dışından Elektronik Karıştırma Faaliyetinin Genel Adı.

[23] "Kara Konuşlu Uzaktan Elektronik Destek (Ed) / Elektronik Taarruz (Et) Kabiliyeti Kazanımı Projesi", Savunma Sanayii Başkanlığı, https://www.ssb.gov.tr/website/contentlist.aspx?pageıd=1082&langıd=1

[24] Arda Mevlütoğlu, "Suriye Göklerinde Elektromanyetik Saklambaç: Koral S-400'e Karşı", Siyah Gri Beyaz, 28.02.2016, https://www.siyahgribeyaz.com/2016/02/suriye-goklerinde-elektromanyetik.html

[25] Redet, Aselsan, https://www.aselsan.com.tr/redet_radar_edet_sistemi_7227.pdf

[26] "Radar Elektronik Destek/Elektronik Taarruz (Redet-II) Projesi Kapsamında Radar Elektronik Destek Sistemi Teslimatı Tamamlandı", Savunma Sanayii Başkanlığı, 09.11.2019, https://www.ssb.gov.tr/website/contentlist.aspx?pageıd=2213&langıd=1

[27] "World Air Forces 2020", Flight International, https://www.flightglobal.com/download?ac=66025

[28] Arda Mevlütoğlu, "Türk Phantom'ları", Siyah Gri Beyaz, 25.03.2015, https://www.siyahgribeyaz.com/2015/03/turk-phantomlar.html

[29] Cem Doğut, "Türk Hava Kuvvetleri`Nde F/Rf-4e Phantom Iı", Defence Turkey, Sayı 98, https://www.defenceturkey.com/tr/icerik/turk-hava-kuvvetleri-nde-f-rf-4e-phantom-ii-3914

[30] Turkey'nin Hava Savunma Sistemi İhtiyacı Ve S-400 Alımı İle İlgili Olarak Bkz: Arda Mevlütoğlu, Sertaç Canalp Korkmaz, "Turkey'nin Hava Savunma Şemsiyesi Ve S-400", ORSAM, 12.09.2017, https://orsam.org.tr/tr/turkiye-nin-hava-savunma-semsiyesi-ve-s-400/

[31] Sıtkı Egeli, «The Fighter Jet That Could Break Us-Turkey Defense Relations", Middle East Institute, 26.06.2018, https://www.mei.edu/publications/fighter-jet-could-break-us-turkey-defense-relations

[32] Turkey'nin S-400 Alımı ve F-35 Projesinden Çıkarılmasının Etkileri İle İlgili Olarak Bkz: Arın Demir, "Arda Mevlütoğlu: Turkey'nin Şu Ana Kadar Askeri Alanda Geliştirdiği Endüstriyel, Siyasi, Teknolojik İlişkilerin S-400 Alımından Dolayı Radikal Bir Şekilde Değişme Olasılığı Bulunuyor", Daktilo1984, 03.05.2020, https://daktilo1984.com/roportajlar/arda-mevlutoglu-

turkiyenin-su-ana-kadar-askeri-alanda-gelistirdigi-endustriyel-siyasi-teknolojik-iliskilerin-s-400-alimindan-dolayi-radikal-bir-sekilde-degisme-olasiligi-bulunuyor/

33 "Hassas Güdüm Kiti (HGK)", Tübitak Sage, http://www.sage.tubitak.gov.tr/tr/urunler/hassas-gudum-kiti-hgk

34 "HGK", Aselsan, https://www.aselsan.com.tr/hgk_hassas_gudum_kiti_6323.pdf

35 "Kanatlı Güdüm Kiti", Tübitak Sage, http://www.sage.tubitak.gov.tr/tr/urunler/kanatli-gudum-kiti-kgk

36 "Kanatlı Güdüm Kiti", Aselsan, https://www.aselsan.com.tr/5beca2f6-02db-45c8-a295-a3cb623a6bc5.pdf

37 "Teber Lazer Güdüm Kiti", Roketsan, https://www.roketsan.com.tr/urun/teber-lazer-gudum-kiti

38 "Teber Güdüm Kiti'nde Teslimat Başlıyor", TRT Haber, 04.07.2018, https://www.trthaber.com/haber/bilim-teknoloji/teber-gudum-kitinde-teslimat-basliyor-373421.html

39 "Aselsan'ın Lgk-84 Kitleri Gün Sayıyor", C4defence, 11.03.2018, https://c4defence.com/gundem/aselsanin-lgk-84-kitleri-gun-sayiyor/5856/1

40 "Mam-L Mini Akıllı Mühimmat", Roketsan, https://www.roketsan.com.tr/urun/mam-l-mini-akilli-muhimmat/

41 "Mam-C Mini Akıllı Mühimmat", Roketsan, https://www.roketsan.com.tr/urun/mam-c-mini-akilli-muhimmat/

42 "Milli Üretim Bozok, Göreve SİHA'larla Hazırlanıyor", TRT Haber, 02.11.2018, https://www.trthaber.com/haber/bilim-teknoloji/milli-uretim-bozok-goreve-sihalarla-hazirlaniyor-392174.html

43 "Satha Atılan Orta Menzilli Mühimmat (Som)", TÜBİTAK SAGE, http://www.sage.tubitak.gov.tr/tr/urunler/satha-atilan-orta-menzilli-muhimmat-som

44 "Kement Projesi Tamamlandı", Meteksan Savunma, 16.04.2019, https://meteksan.com/tr/haberler/kement-projesi-tamamlandi

45 "Som-J Seyir Füzesi F-35 Entegrasyonu", Savunma Sanayii Başkanlığı, https://www.ssb.gov.tr/website/contentlist.aspx?pageıd=383&langıd=1

46 Fatih Mehmet Küçük, "Türk Silahlı Kuvvetleri ve Esed Rejimi Uzun Erimli Saldırı ve Savunma Kabiliyeti", Defenceturk, 13.02.2020, https://www.defenceturk.net/turk-silahli-kuvvetleri-ve-esed-rejimi-uzun-erimli-saldiri-ve-savunma-kabiliyeti

47 "TSK'dan 'Bilgi Otoyolları'", Hürriyet, 23.06.2000, https://www.hurriyet.com.tr/gundem/tskdan-bilgi-otoyollari-39163291

48 "Adop-2000", Aselsan, https://www.aselsan.com.tr/tr/cozumlerimiz/komuta-kontrol-haberlesme-ve-bilgisayar-c4i-sistemleri/ates-destek-komuta-kontrol-sistemleri/adop2000

49 "Batarya Ateş İdare Sistemi", Aselsan, https://www.aselsan.com.tr/tr/cozumlerimiz/komuta-kontrol-haberlesme-ve-bilgisayar-c4i-sistemleri/ates-destek-komuta-kontrol-sistemleri/batarya-ates-idare-sistemi

50 Alex Gatopoulos, "'Largest Drone War İn The World': How Airpower Saved Tripoli", El Cezire, 28.05.2020, https://www.aljazeera.com/news/2020/05/libya-battle-sky-air-superiority-changed-war-200527135230131.html

51 Dylan Nicholson, "Foreign Drones Turning The Tide İn Libya", Defence Connect, 04.06.2020, https://www.defenceconnect.com.au/strike-air-combat/6218-foreign-drones-turning-the-tide-in-libya

52 Aishwarya Rakesh, "Are Haftar Army's Pantsir Missile Systems Supplied Only By Uae?", 22.05.2020, https://www.defenseworld.net/news/27041/are_haftar_army___s_pantsir_missile_systems_supplied_only_by_uae_

53 Ahmet Alemdar, "Rus Paralı Asker Grubu Wagner Tarhuna'dan Geri Çekildi", 22.05.2020, https://www.defenceturk.net/rus-parali-asker-grubu-wagner-tarhunadan-geri-cekildi

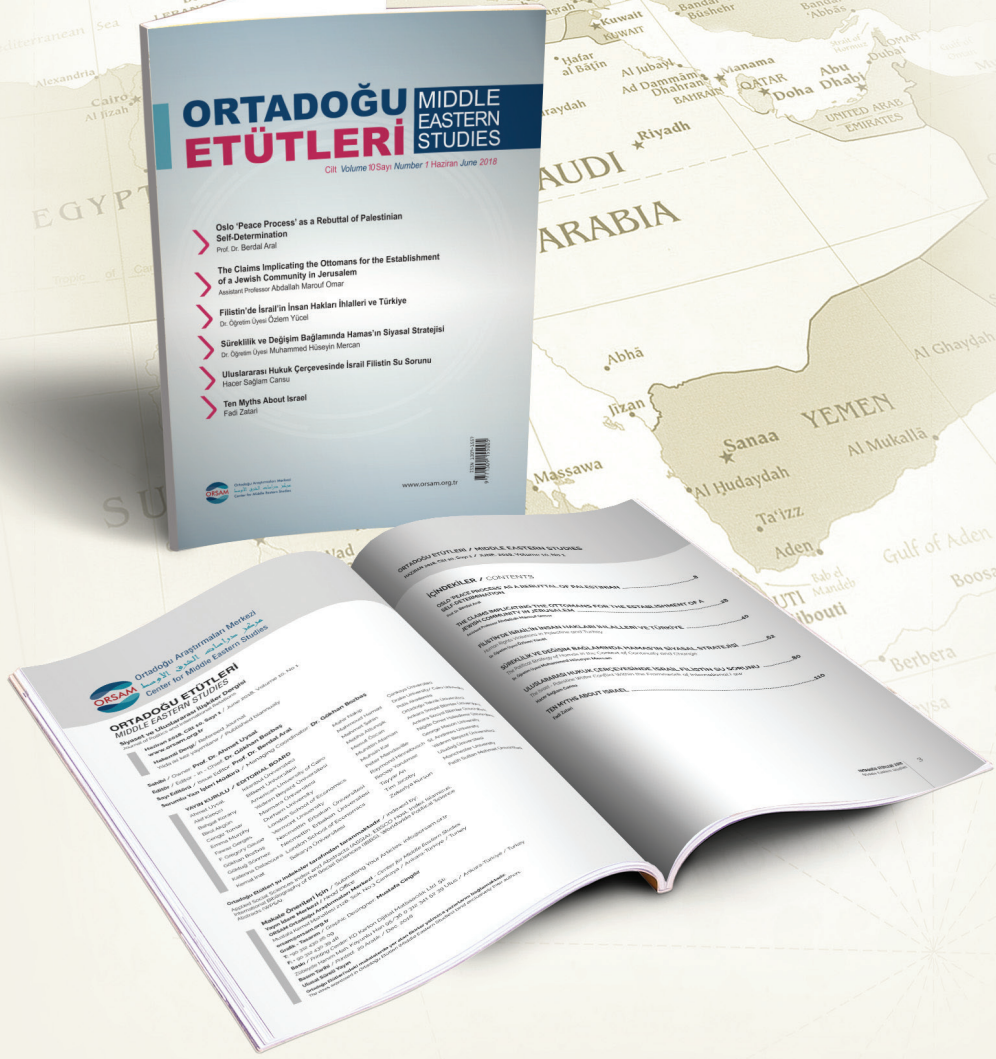
54 Seth Frantzman, "A Secretive Proxy Drone War Just Exploded in Libya", The Jerusalem Post, 20.05.2020, https://www.jpost.com/middle-east/a-secretive-proxy-drone-war-just-exploded-in-libya-628600

55 Collected from open sources and Airforces Monthly..

56 Airforces Monthly April 2020, May 2020

ORTADOĞU ETÜTLERİ

MIDDLE EASTERN STUDIES



Hakemli Siyaset ve Uluslararası İlişkiler Dergisi

ORSAM Publishes

Middle East Analysis and Middle Eastern Studies as periodical journals. Middle East Analysis, which is published bimonthly in Turkish, covers the expert opinions on contemporary developments in the Middle East. Middle Eastern Studies is a semi-annual journal on international relations. As a scholarly and refereed journal, published in both Turkish and English, Middle Eastern Studies is composed of the contributions of academics who are experts in their field. Middle Eastern Studies, where respectable, national and international level academics publishes their papers, is indexed by Applied Social Sciences and Abstracts (ASSIA), EBSCO Host, Index Islamicus, International Bibliography of Social Sciences (IBBS), Worldwide Political Science Abstracts (WPSA).

Mustafa Kemal Mah. 2128. Sok.
No:3 Çankaya/Ankara

+90 (850) 888 15 20
+90 (312) 430 39 48

info@orsam.org.tr
www.orsam.org.tr

orsamorgtr