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#### PEACE REQUIRES A STRONG ARMY AND DEFENSE INDUSTRY

Ardan ZENTÜRK Editor-in-Chief

The world is going through a period in which the hopes of the generations who had to live in different ideological camps divided into two were revived with the fall of the Berlin Wall on Nov. 9. 1989, but have since faded considerably. For the '68 and '78 generations, who opposed the Cold War conditions that took shape after World War II, the collapse of the wall meant the removal of not only the political boundaries between humanity, but also all human-made borders in general, and the emergence of a basis for permanent and sustainable peace. It didn't happen. On the contrary, we watched the concept of "war" re-emerge on the critical fronts of Eurasia, starting with the bloody Balkan War of 1992-1996, then the Caucasus and eventually Ukraine. It was thought that the end of ideological polarization would bring detente and peace to the developing regions of the world, especially the Middle East, but the opposite happened in places like Afghanistan, Iraq, Syria, Lebanon, Libya, Sudan, Yemen and Palestine. We are now witnessing bloodbaths. We can understand from the great destruction around us that the fate of nations suffers when there is movement away from democracy and the rule of law, mistakes are made in national survival measures while experiencing drifts in domestic politics. Technologies, lifestyles, cultural identities and all concepts that provide differentiation between generations are changing. Only one concept that comes from the deepest history of humanity does not change: The main elements of a nation living in peace are a "strong army" and a "strong defense

industry" to keep this army alive. For this reason, I attach importance to the following statement made by Professor Dr. Haluk Görgün, the president of the Defense Industry Agency of Türkiye, within the framework of the IDEF'23 International Defense Industry Fair:

"We actually want to base the development of our defense industry on the axis of world peace. In all the products we will develop, we strive to make the world more peaceful and free from wars, and with our reliable systems, we aim to create a sustainable environment beyond just shopping and sales, but a market based on technology. We build ties on sustainable bilateral-multiple relations. Everything we develop will be used for world peace, justice, rights, law and values in the world."

The wars experienced today show that achieving victory is not easy at all. The reason is the point conventional war technology has reached and this increases the risk that the armies that appear to be the strongest can still be defeated Developments in the defense industry transform all quests for victory into a "Pyrrhic victory." So, when you think you have won, you will have achieved nothing more than great destruction. The risk of this "conventional deadlock" can ultimately lead to a "nuclear showdown frenzy." As Görgün underlines, it introduces the search for sustainable and lasting peace to the agenda. "National survival" also means "strong deterrence." With a strong army and an effective Turkish defense industry that supports it with 80% of its needs, the country's formula is correct and progressing.



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## FRONTLINE GAME CHANGER

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FIR

The T-155 Firtuna is a heavy-class self-propelled artillery system actively used by the Turkish Land Forces (TLF). As a significant part of the localization of the Turkish Armed Forces, it's important to discuss how the T-155 project came about by exploring the artillery systems used by the land forces. By examining subsequent developments, we can then analyse how the project is progressing and make predictions about its future as well as discuss the impressive features of the system itself.

#### ARTILLERY SYSTEMS IN THE TAF INVENTORY

The TLF uses mortars, towed howitzers and self-propelled howitzers, including the T-155. Mortars are used by infantry units, while artillery units use towed and self-propelled howitzers. While there are more than 75 105 mm M101A1s, 517 155 mm M114A1/A2s, 40 155 mm Panthers and 162 203 mm M115 towed howitzers in the inventory of the Turkish Land Forces, the self-propelled howitzer class boasts the T-155 Firtina. There are approximately 150 155 mm M44T1s, approximately 365 155 mm M52Ts, 36 175 mm M107s and 219 203 mm M110A2s self-towed howitzers. The Turkish Land Forces also has 280 T-155 Firtinas in its inventory.

#### BEGINNING AND PROGRESS OF THE T-155 PROJECT

Türkiye purchased M52 self-propelled howitzers from the U.S. between 1963

There are 280 FIRTINAs and eight FIRTINA-IIs in the Turkish Land Forces' inventory. and 1966. By 1995, Türkiye decided to modernize the M52s and by 1998, sufficient kits were purchased for the modernization of the artillery systems, with the modernized M52s renamed M52T. M44s, purchased with the M52s, started to be modernized in 1986, and the modernization was completed in 1992.

The T-155 project was launched in 1995 under the T-155 Firtina Modern Howitzer Development Program to embody the experience gained from these modernizations. The first T-155 prototype was delivered in 1997 after being produced based on the South Korean K-9 Thunder. Although it was first designed to use a 155 mm 39 caliber gun in the production of the prototype, a longer range 155 mm 52 caliber gun, which would be suitable for the battlefield of the era and the coming years, was installed. Likewise, the subsystems of the German PzH 2000 howitzers were initially considered during the production process of the prototype, but since Germany prevented this sale, the platform's subsystems were supplied by the South Korean company Samsung Techwin. Production of the second prototype started in 2000, and the howitzer's hull, tower and suspension systems were completed in late 2000, along with the integration of the subsystems. These prototypes were produced with the one ball-one battery principle. In 2001, a contract was signed with South Korea for the supply of automatic loaders and 155 mm weapon systems. On April 20, 2004, the first T-155 Firtina was delivered to the Turkish Armed Forces.

T-155s were first used in Operation Sun, which was launched in 2008, and were later used in various cross-border operations. They have been used in many comprehensive operations such as Operation Euphrates Shield, Operation Olive Branch, Operation Peace Spring and Operation Spring Shield, and are still actively used as one of the most important firing systems of the Turkish Armed Forces in cross-border operations.

#### T-155 FIRTINA TECHNICAL INFORMATION

Mass production of the T-155 Firtina was carried out at the 1st Main Maintenance Center Command of the Land Forces Command. In addition to having a length of 12 meters (39 feet), a width of 3.4 meters and a height of





3.43 meters, it weighs 47 tons and operates with a crew of five. Firtina also has night vision and nuclear, biological and chemical (NBC) protection. It has a maximum speed of 65 kph and an operational range of 360 kilometers (224 miles). The howitzer, which can climb slopes up to 60%, has a 1,000 hp MTU 881 diesel engine of German origin and an Allison x1100-5A3 automatic transmission system of U.S. origin. In addition, there are also T-155 Storms with the South Korean power group. At the same time, the power-to-weight ratio of the storm is 21 BG/ton. The suspension system of the howitzer is hydropneumatic. The main weapon system of the T-155 Firtina is produced by MKE. The barrel diameter of the weapon system produced by MKE is 155 mm 52 caliber. The firing system, which has automatic

> T-155 Firtinas are also integrated with the ADOP-2000 fire support automation system produced by ASELSAN.



T-155 Firtina is also integrated with the ADOP-2000 Fire Support Automation System produced by ASELSAN. Thanks to the ADOP-2000 system, it is a system that has an important place in making the necessary plans to hit the target at the appropriate time with the appropriate weapon system and appropriate ammunition. The ADOP-2000 system, which is a command, control, communications, computer and intelligence (C4I) system, includes towed and self-propelled howitzers, BAİKS-2000 (a battery fire direction system) and HAİKS (a mortar fire direction system). ADESTIM (a fire support team surveillance system), a Cobra weapon/mortar detection radar, ANTPO 36, advanced observer systems, ARS 2000 ground surveillance radar, TOMES (an artillery meteorology system), YÖHM (a ground surveying information center), YİTP (a ground direction determination crucible) and multi-barreled rocket launcher technical fire management systems are also integrated.

#### T-155 FIRTINA-II

The development of T-155 Firtina-II as a new generation howitzer, with the experience gained from the T-155 Firtina, started in 2018 within the scope of the New Generation Firtina Howitzer Project. Within the scope of this project, the production of the first three howitzers was completed in December 2020, and they were added to the land forces inventory during a ceremony held on Jan. 23, 2021. In these howitzers produced by BMC Defense, the Germanorigin 1,000 hp MTU 881 diesel engine used in older version howitzers and the U.S.-origin Allison x1100-5A3 automatic transmission system were used. However, it was revealed to the public that 53 units of the U.S.-origin 1,200 hp AVDS-1790-9A diesel engine, the use of which was determined during the development process of the project, were ordered and the first two of these engines were to be delivered in June 2022. The remaining engines were to be delivered by the end of 2022. In addition, it was reported in the press that the power group consisting of the X1100<sup>™</sup>-5A4 automatic transmission system and AVDS-1790-9A engine produced by Allison for the new generation Fırtına howitzers was considered for use. However, in the end, the power group problem will be solved by using the German power group for the first eight produced and switching to the UTKU domestic power group produced by BMC POWER in 2025. Unlike Firtina,

ASELSAN-produced electrically driven turrets and barrel guidance units, howitzer fire control systems, fully automatic loading systems, gunpowder conditioning units, air conditioning systems and SARP UKSS (remote-controlled weapon systems) are integrated into the Fırtına-II howitzer.

It is known that eight howitzers have been produced so far within the project, which includes the production of a total of 140 T-155 Firtina-IIs. In 2023, the Ministry of National Defense announced that it is scheduled to receive four Fırtına-IIs. Two of these howitzers were delivered on Aug. 25, 2023. With these deliveries, a total of eight howitzers have been delivered to the Turkish Armed Forces. BMC has announced it plans to produce two more Firtina-IIs with the German power group and that it will use the UTKU Power Group to be produced by BMC POWER in the 130 T-155 Firtina-II howitzers planned to be produced as of 2025. The UTKU Power Group Project is a V-type 8-cylinder engine project carried out by BMC POWER and capable

of producing 1,000 hp. UTKU, of which 10 prototypes have been produced so far, was successfully fired for the first time in 2020 and the tests of the system are ongoing. In addition to these developments, there is a strong possibility that some T-155 Firtinas, in addition to the newly produced T-155 Firtina-IIs, will be modernized and upgraded to the Firtina-II level.

With the nationalization of the systems in the new generation Firtina-II howitzers produced by BMC and the integration of the UTKU power group produced by BMC POWER, there will be no obstacle for Türkiye regarding the export of Firtinas.

With the introduction of the UTKU power group developed by BMC POWER, there will be no obstacle to the export of FIRTINAs and FIRTINA-IIs.



# THE BIRTH OF STEEL DRAGONS

Süleyman ÖZMEN ★ War Technologies Expert

The defense capacity of states depends in many ways on the weapons used by their army. In this context, new military vehicles are developed every year for the defense of the country. The tank is specifically designed to be the weapon of choice in conventional warfare.

Since ancient times, people have constantly strived to find destructive means of warfare that would strike and spread terror. We can see the various results of these in the form of light two-wheeled chariots, closed chariots, armored knights and heavy cavalry in the ancient Chinese, Assyrian, Egyptian and Roman civilizations, albeit according to the simple technologies of their times. For example, Hannibal and Timur's elephants were also used like today's tanks.

Leonardo da Vinci, the famous great artist of Renaissance Italy, was able to create a sketch of the modern tank and armored vehicle with his superior imagination and successful drawings. He explained its use as follows: "I make closed, safe and destructive chariots. When they advance by firing their cannons, even the strongest enemy ranks will have to retreat and dissolve. After them, our own infantry will be able to advance safely and without resistance."

Over the centuries, many military and civilian individuals have tried to make sure-fire weapons like Leonardo da Vinci. When World War I started in 1914, the parties were committed to the classic strategies, and it was thought that modern weapons such as rapid-fire cannons and improved machine guns would not greatly affect the character of military operations. When the war commenced, there was a general belief on the opposing sides that this struggle would be over within weeks, not years or months.

However, the Schlieffen Plan, which was prepared to ensure the quick defeat of France, could not be implemented as hoped. The Germans were stopped in the Marne. France remained undefeated, creating stagnation on the front and leading to the mutual trench system starting from the Swiss border to the shores of the English Channel.

With the trench warfare, a very bloody period with many casualties for both sides started and the war continued for four years. At the end of November 1914, three months after the start of the war, British and French casualties approached 1 million. By the autumn of 1915, however, insistence on the use of cavalry for the breakthrough continued. These tactics led to extended mutual artillery duels and the destruction of enemy fortifications and machine gun nests until the end of 1915.

Meanwhile, Scottish Captain George Swinton's efforts were drawing to a close. Swinton had observed the inertia of the armies that had participated in the battles in France and lost their

After the first tank offensive, military writers rallied around the main idea that: "The British have lost the possibility of a major military raid. If this weapon had been used in large quantities and in a timely manner, the course of the war could have changed."



means of operation, and that the war of position was a formidable dragon that devours man and material. Prime Minister Winston Churchill supported his struggle to get the generals to accept the idea of a "land destroyer," which he had not previously considered or put into practice before the war. Swinton determined the shape and quality of the first tank with a large staff of engineers and technicians, and production started. In September 1915, the first tank was tested in Wembly Park, and the experience was positive. It was then necessary to name the vehicle. Many names were proposed and as a result, the most appropriate, "tank," in terms of secrecy was deemed appropriate. The first tank training ground was established in the Siberie Camp area in Bisley. The crew was chosen

from among the army units and volunteers. This crew did not know what they had been chosen for or what they had come for. Before the training started, they weren't given any weapons to use.

The first training programs were for infantry, machine guns, cartography, engine repairs and handling the 6-pound cannon. When the first tank arrived at the "Mark 1" training center, many of the volunteers refused to take a closer look. They even doubted that this formless mass of iron could even move. Despite their hesitancy, the first unit for the vehicle was established, called the Motor Machine Gun Service (MMGS). Since July 27, 1917, the name of this vehicle class has been referred to as "Tank," and the name has since stuck.

#### **CHRONOLOGY OF TACTICAL USE**

On the morning of Sept. 15, 1916, the Germans manned positions they thought were insurmountable, under the safety of rows of wire fences and the protection of deadly machine guns. In the early hours of the morning, surrounded by a light haze, in a water-filled trench, a scout named Fritch, exhausted from lack of sleep, was startled by a strange sight. He couldn't believe his eyes. He watched in amazement as creaky metal noises and the strange vehicles making them approached, advancing closer without being hindered by the pits, trenches, mud or wire fences. He immediately grabbed his phone to report what he had seen. They made fun of him. He knew it was crucial to describe what he saw, which required abandoning his post. They accused him of cowardice.

Desperate and helpless, he waited for the metal dragons to approach. Soon Fritch and hundreds of his friends perished under the tracks of the ruthless weapons. These soldiers were the witnesses of the start of new tactics among

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the mud and corpses that led to a great revolution in the history of war. They were the first to become acquainted with the "Tank." Soon, two British tank divisions, whose training and organization were partially completed, were transferred to France. In preparation for this famous attack, on Sept. 10, 1916, these tanks were lowered from trains at the Loop station near the Somme front. This station was about 16 kilometers (10 miles) from the front line. The unloading was done at night and the unit was gathered in a previously unexplored and unknown area.

The next day, to prepare for the attack, the commanders of these companies visited the corps and division commanders at the front. The purpose was to obtain information about the enemy's positions and terrain and to plan the offensive. However, the company commanders could not find a commander or officer to explain the details. As a result, a meeting was held by order of the commander-in-chief.

At this meeting, which consisted of various class officers and commanders, the infantry's attack and the artillery's support plans were explained to the tank officers, and it was decided that the tanks would take action one and a half hours before the infantry's scheduled attack. However, the location was unknown to the tank officers, and they didn't even have a map of the area.

Under these circumstances, the tank officers guided the drivers by telling them what they saw on the terrain. On the night of Sept. 14, the tanks left the assembly area to approach the attack position and advanced on an unknown terrain. Many tanks broke down along the way, and for this reason, only 32 of the 49 tanks were able to reach the front. The arrival of only 32 tanks at the front required a change of plan, with 17 tanks assigned to the 14th and 15th corps, eight tanks to the 30th corps, and seven tanks to the reserve forces.

The tanks were on the move an hour and a half before the infantry's attack time.

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Armor protection has been the basis of durability since the tank was introduced in 1916 and has been the most studied topic in both tank production and the development of antitank weapons.





The enemy front was soon torn open and thrown back several miles. But unfortunately, these metal dragons had also reached their limits at this point because they were running low on fuel. Despite all this, this first tank offensive gave rise to a tank tactic.

Although this weapon had a dominant effect and was able to break through a limited part of the German front with a few unexpected casualties, the desired result could not be achieved for the following reasons:

- Insufficient training of staff,
- Low movement capacity,
- Technical difficulties,
- No determined tactics,
- The lack of a large battalion.

After the first tank offensive, military writers rallied around the main idea that: "The British have lost the possibility of a major military raid. If this weapon had been used in large quantities and in a timely manner, the course of the war could have changed." Historians mostly agree that these observations are true.

However, the idea of Capt. Swinton, the creator of the tank, to test the weapon in exercises before using it in battle was not accepted by the British generals. The generals silenced Swinton, arguing that, "Such a weapon should not be tested in friendly territory but in real combat and against the enemy."

The Germans, on the other hand, were haunted by the attack even three months on. Thinking that the war would be over in a few months, they believed it was too late to consider countering such a weapon by developing one of the same type.

As a result, they did not attempt to develop the technology until January 1918, and then only five tanks were sent to the front. In fact, Marshal Hindenburg, who inspected the unit, said: "I don't think these vehicles will do much. But since it has been made once, of course, we will also use it." The Marshal's distrust of the weapon greatly affected the German units assigned to use it.

Although England's first tank attack was partially successful, the mistakes in the management and training and the lack of training were clearly visible. Despite its flaws, the attack did allow the advancing infantry to reach the front line and caused significant damage to the enemy positions. Although nine tanks did not join the attacking forces, those that did make it to the front line were effective in clearing the remaining resistance.

Thinking that the war would be over in a few months, The Germans believed it was too late to consider countering such a weapon by developing one of the same type. As a result, they did not attempt to develop the technology until January 1918.



The remaining nine tanks were damaged and five were destroyed. At the end of this offensive, the following technical and tactical techniques were learned:

– Unless the tank is used with effective tactics, the weapon is nothing more than a dramatic invention,

– Tank tactics should be developed and tanks should be used en masse,

 Units in charge of the tank should be subjected to joint training and due importance should be given to this,

- The tank had to be dealt with and developed in many aspects from a technical point of view,

– The armor thickness needed to be improved,

– The tail wheels at the back of the tank were seen as heavy and impractical,

– The movement capacity of the tank was too limited.

Following the use of the Mark-1 tank at Flers on Sept. 15, 1916, Schneider tanks were first deployed in France on April 16, 1917, at Berry-au-Bac. At the end of 1917, the Whiffet tank, a series of medium tanks, entered service in England. Its weight was 14-20 tons and its range was 100 kilometers. Serial production of Renault-FT light tanks began in France in 1918.

French and American forces were immediately equipped with these tanks. These tanks, which later spread to many countries, became the basis of armored weapons in the period between the two world wars. In 1918, preparations for the offensive led to the emergence of heavy tanks. Its French prototype, the FCM I-A tank, weighed 42 tons and was armed with a 105 mm gun. The FCM II-C tank weighed 68 tons and was strong enough to pass through the northern channels of France. The 35-ton Mark-V tank, carrying two 57 mm guns, was manufactured in England in 1918 and remained in service until 1930.

Here we can easily say that the tank's use in weapon systems worldwide had a very important effect on the fate of World War I. During the 15 years following the peace of 1919, successful tank models were made in many countries, but mass production was not started due to the abundance of war stocks.

Britain launched the first amphibious tank in 1921, while France was researching a tank with a 155 mm gun under the turret; the U.S. produced its first original tank, the Christie (Kristi), in 1931. This tank weighed 13 tons and moved on wheels or tracks. The D-1 tank (with a 47 mm gun, weight of 13 tons and speed of 18 kph) produced in France on the same date is the last of the tanks from World War I. However, this model has also changed and added a radio.

Indeed, many light tanks made in 1933 showed a new trend. Equipped with a heavy machine gun, 10-12 mm thick armor and weighing 3.5 tons, the speed of these new tanks reached 40-60 kph. These include the Fiat Ansaldo, British Vickers and French Renault tanks. With the general rearmament in 1936, new tanks appeared at the beginning of World War II.

The improvements made in the engines in these tanks allowed them to exceed

Britain launched the first amphibious tank in 1921, while France was researching a tank with a 155 mm gun under the turret; the U.S. produced its first original tank, the Christie (Kristi), in 1931.



10 hp per ton. Likewise, optical instruments were made more sensitive. The radio installed in almost all tanks replaced the pennant system. However, the purpose of the construction of these tanks was to reconcile the factors of power (weapon), speed (engine) and weight (armor), and these tanks were prototypes in nature. Among these tanks are the 10-ton light tanks Renault R-35, R-40, Hotchkis H-35, H-39 and the FCM-36. In Germany, on the other hand, very light tanks were built first and were armed only with heavy machine guns.

However, after the lessons learned in the Spanish civil war, the production of heavier and better armored tanks began. The American M-3 and M-5 tanks with 37 mm guns were the best light tanks in the second half of World War II. Their strength, and therefore their weight, increased significantly. The German armed forces used the Panther and later the Tiger tanks. Russia, on the other hand, owes its success to the T-34 tank. The T-34 was suitable for the field and had wide tracks for easier movement on soft soil. In 1944, the heavily armored and rather low-velocity Stalin tank appeared, equipped with a 122 mm gun. Initially unequipped, the United States first took advantage of the Grand tanks, which were a poor copy of the French B tank. They then succeeded in the serial production of Sherman tanks. This tank later spread in large numbers to all Allied armies. Together with the French FT and Russian T-34s, the Grands are some of the most successful in tank history.

In this period, England, besides the 26-ton Matilda, 16-ton Valentin and Churchill tanks, used different types of Cruiser tanks, equipped with a fast 47mm gun. It can be said that tanks played a very important role in World War II as well. After World War II, armies were equipped with tanks of approximately 50 tons. The Stalin tanks in Russia, Patton tanks in the U.S. and Western countries, and the Centurion and Conqueror tanks in England were equipped with guns with a diameter of 80-112 mm in the turret, and most have rangefinders and anti-aircraft guns. In the same years, the German army was equipped with 40-ton tanks, a variant of the Panther. The tank's value became a matter of debate after 1945, when two weapons that were the tank's ruthless enemy, guided missiles and spherical corrective bullets, emerged.

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The T-34 was suitable for the field and had wide tracks for easier movement on soft soil. In 1944, the heavily armored and rather low-velocity Stalin tank appeared, equipped with a 122 mm gun.



But the discovery of nuclear weapons reaffirmed the tank's true value. Indeed, tanks not only provide protection from blast winds, heat and radiation but can also quickly move away from the radioactive polluted area, even over rough terrain, thanks to their tracks. The tank is still at the center of most armored units and stands out, especially in terms of its effectiveness against the anti-tank weapons developed in the 1970s. Although discussions have touched on the weakness of tanks, thanks to their distinctive and superior features such as mobile firepower, impact capabilities and survivability, the pros outweighed the cons, and it is the first piece of equipment that comes to mind when the armored units are discussed.

Despite efforts to exceed its superiority, in terms of its survivability, especially against the anti-tank and other weapons, its prominence has remained firm, and no military vehicle has been able to top the capabilities of tanks and their durability against weapon systems. However, with the help of rapidly developing technology, armored combat vehicles, armored personnel carriers, self-propelled artillery and anti-aircraft and rocket systems, armored helicopters support and integrate armored troop operations. Today, the rapid and sudden developments in world geopolitics as a result of the disintegration of the pacts and the change of balances have increased the possibility of regional crises and conflicts, and the regained independence has led to ethnic or religious conflicts.

It is open to debate whether tanks will continue to be the weapon of choice due to the above-mentioned conflicts' characteristics. While the second- and third-generation wars were fought within certain basic principles, today's wars are riddled with corruption and irregular war elements, meaning that the rules, basic war principles and human values are ignored.

Produced in accordance with tactical and conventional use and used as a

decisive weapon as an effective instrument in conventional wars, the effectiveness of tanks in wars fought without principles is widely discussed by experts today. In the context of this discussion, let's take a closer look at the expected developments in tanks in relation to their firepower, survivability, command and control, and mobility.

#### **FIREPOWER / WEAPON SYSTEM**

The diameter of the guns used in the tanks of Western countries is



Produced in accordance with tactical and conventional use and used as a decisive weapon as an effective instrument in conventional wars, the effectiveness of tanks in wars fought without principles is widely discussed by experts today.





105/120 mm, and the diameter of the tank guns used in the tanks produced by the Eastern Bloc countries is 115/125 mm. In the near future, it is not expected that there will be any significant changes in the intermediate generation tanks as far as modernization is concerned, except for increasing the tank gun diameters from 105 mm to 120 mm or from 115 mm to 125 mm. Thermal imaging has also been integrated for the tank's commander, gunner and driver.

#### FIRE CONTROL SYSTEM

Most of the tanks use YAG type, while some of them use CO2 laser range finders. In the modernizations to be made, it is expected that CO2-type laser rangefinders will be used in all tanks, and a second distance measuring system that backs up the laser will be used in new types of tanks to be produced in the following years. Calculators used in tanks produced after World War II were replaced by analog calculators in the second intermediate-generation tanks produced after 1970. The calculators used in the third-generation tanks are digital and all ballistic information (air temperature, bullet temperature, wind speed, air pressure, the inclination of the tank, etc.) is transmitted automatically via sensors.

#### AMMUNITION

There are two types of ammo that can be shot with tank guns, namely "kinetic energy" ammunition and "chemical energy" ammunition used against thickly armored targets. Experts predict that APFSDS-T ammunition with tail-balanced sabotage armor piercing trace will continue to be used as the main ammunition in tanks, but efforts to increase the performance by using depleted uranium to increase the initial velocity as well as lengthening the bullet length and increasing the penetrating property of the bullet will continue. The chemical-energy ammunition HEAT-T has been replaced by the multipurpose HEAT-MPT ammunition and is still in use. The tank gun ammunition sleeve, which was used as a full shot in the past, has been replaced by the combustible sleeve. Due to the increase in the diameter of the guns, the use of automatic filler in the tanks strengthens the possibility that the ammunition will be produced with fully combustible shells in the future.

#### **AUTOLOADER**

To reduce the casualties by limiting the tank's crew in the Eastern bloc, an automatic loader was used on the T64, and the first installation in Western

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The diameter of the guns used in the tanks of Western countries is 105/120 mm, and the diameter of the tank guns used in the tanks produced by the Eastern Bloc countries is 115/125 mm.



countries was made in the Leclerc tank produced by France. In addition to reducing the crew, the size of the tanks was also reduced. Autoloaders were installed to overcome the limitations of manpower due to the increase in the weight of the ammunition for the larger gun diameter, the decrease in the amount of ammunition to be carried in the tank and the increase in the time difference between two shots. Although it provided advantages for quick fire, the difficulty of manually reloading if the system malfunctioned created a new issue.

The likelihood of an increase in the diameter of the guns in new model tanks produced after 2000 will make the installation of the automatic filler system obligatory.

#### DURABILITY / ARMOR PROTECTION

Armor has been the basis of durability since tanks were first used on the battlefield in 1916 and has been the most studied topic in both tank production and the development of antitank weapons. When tanks appeared in World War I, they were known to be covered with an average of 12 mm of armor. In 1945, 102 mm homogeneous (cast steel) armor was used on American Pershing tanks and 185 mm on King Tiger tanks. Later, with the emergence of anti-tank bullets working with the principle of cavitation, the need to develop existing tank armor arose, and its vulnerability against cavitation-correct bullets was overcome with the addition of a second armor with holes using reinforced steel, aluminum and various materials.

Armor development studies continued with the "Reactive Armor" that Israel invented and used in 1982. This armor consists of very simple boxes containing special and sensitive explosives placed in the most vulnerable compartments of the tank. The cavitation bullet that hits this explosive is pushed back as a result of the immediate detonation of this explosive and cannot damage the armor.

In addition to this advantage, the weight of tanks with reactive armor increases by 850-

1,500 kilograms (1,875-3,300 pounds). However, it should not be ignored that the protection provided by reactive armor can only be provided with 10 tons of steel. This superiority of armor over anti-tank projectiles has been revealed by new missiles with "Tandem" double-detonating warheads. In addition, it has started to be developed with both kinetic and hollow-formed projectiles (the Explosively Formed Project).

Missiles that will hit the tank from above can also be effective despite the reactive armor. As a result of the armor development studies carried

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Armor development studies continued with the "Reactive Armor" that Israel invented and used in 1982.

U.S. Marines from Company D, 2nd Tank Battalion, drive their M60A1 main battle tank during a breach exercise in Operation Desert Storm in 1991. The tank is fitted with reactive armor and an M-9 bulldozer kit.



out against double detonation projectiles, the British designed layered and combined (Chobham) armor. In this armor, there are layers of steel, plastic and especially ceramic. The main material is ceramic and is harder than steel and does not melt. The Challenger, M1 Abrams, Leopard 2 and T 64/72/80 series tanks are the product of this armor type.

This armor provides full protection against dimpled bullets, partial protection against kinetic energy and Tandem bullets and can absorb their penetrating power. The weakened uranium armor developed by the Americans to completely eliminate the penetrating properties of kinetic-effect bullets made the armor impenetrable again. This type of armor has been used on M1A1 and M1A2 tanks since 1988. As a result of the development of antitank shells, that armor technology was not sufficient, and the "Active Armor" design emerged. The armor is designed to neutralize projectiles launched at the tank with active or passive measures after detection. After detecting the threat, the passively cautious

armored vehicle deceives the missile by hiding itself or by launching a decoy (fake image). Actively cautious armored vehicles, on the other hand, detect the threat and are based on the principle of destroying the threat with counterfire before it can hit the tank. Detection and destruction of the threat take place in 12 milliseconds, and the missile can merely move centimeters during this time.

#### **NBC PROTECTION**

Pressurized-type NBC protection with gas masks and gas-particle filters has started to be used in second-generation tanks, and pressurized-type NBC protection is still used in modern tanks.

#### FIRE EXTINGUISHING SYSTEMS

The fact that today's tanks use diesel has led to the idea that the chance of fires has completely disappeared; therefore, the fire extinguishing systems are lax. To prevent fires and explosions inside the hulls and turrets of the newly developed tanks, it is expected that the infrared sensor and heat detector systems, which can detect fires in 23 milliseconds and suppress them in 710 milliseconds, will also be used. However, due to the reasons stated above, personnel should be sure to maintain these systems.

#### **COMMAND CONTROL**

Today and in future battles, commanding a single tank, unit and fighting at the same time are inseparable elements. For this purpose, Frequency Hopping Radios, positioning systems and in-vehicle information systems are used and will continue to be used in the future.

#### **ENGINE POWER**

The most important issue to be considered in perfecting mobility is the power source. This is the most important part of the tank modernization and new design. Parallel to the increase in the weight of the tank, the engine power was increased to 1,500-1,800 hp. With the currently used 1,500-1,800 hp gas turbine engine, electric transmission and hydropneumatic suspension systems will also be used in the future.





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# **KAPLAN THE PERFECT BALANCE IN MODERN MILITARY WARFARE**

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KAPLAN

COCKERILL' 3105

The specific requirements of frontline combat elements are being reshaped by numerous factors, such as new threats, new technology, tactics, doctrines and so on. In the ever-changing landscape of the modern warfare, medium weight tanks have emerged as an optimum balance of firepower, mobility, and protection. These versatile armored vehicles will fill the gap between main battle tanks and light armoured vehicles, offering a balanced solution for modern military operations.

Medium weight tanks have been characterized by their adaptability to a wider spectrum of combat scenarios. Its medium weight enables better maneuverability and deployability compared to main battle tanks, while providing enhanced protection and firepower compared to light armored elements. This versatility enables military forces to respond rapidly and effectively to a wider range of operational requirements. As a force multiplier, medium

tanks are becoming invaluable assets in both conventional and unconventional operations where maneuverability and rapid deployability is paramount.

FNSS's KAPLAN MT is a unique sample of response to emerging requirements in modern warfare. KAPLAN MT's well-designed platform offers the lowest silhouette and highest power to weight ratio in its class. Its platform is designed for optimum weight and high mobility performance. The vehicle features the latest technology power pack, combined with advanced electronically controlled systems, an Auxiliary Power Unit (APU), and a heavy-duty suspension system. These features enable the vehicle to ensure the freedom of high,



reliable and continuous power during expeditionary maneuvers on the battlefield for day and night operations. The advanced mobility system of the KAPLAN MT enhances user ergonomics and extends the overall mission equipment's lifecycle.

KAPLAN MT's design architecture provides a superior level of battlefield survivability which comprises of advanced ballistic and best-in-class mine protection systems. An active protection system can also be integrated as on option, based on user requirements. KKAPLAN's interior design is highly focused on user ergonomics and optimum crew comfort to increase overall performance of its users' operational tasks. KAPLAN MT is equipped with day and thermal cameras, a multi-functional driver dashboard and wide-angle optical periscopes for the driver. To provide a hunter-killer capability a third-generation high performance sight system is also situated for the gunner and the commander. In addition, Battlefield Management Systems (BMS) and Laser Warning Systems (LWS) are also available to provide a

high level of tactical situational awareness for the crew. MARCH 2024

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The Unique Anti-Armored Punch for KAPLAN MT is fitted with the latest generation turret equipped with a high-pressure 105 mm gun offering adequate firepower against battlefield threats with great speed of response within a short period of time. It is an ideal choice of weapon for direct and indirect fire missions together with infantry support roles. Its unique indirect accurate firing capability permits engagement in both open field and multi-complex urban terrains. KAPLAN MT is in the Indonesian Army's inventory as the first export contract of Türkiye in the medium-weight tank class.

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KAPLAN MT is equipped with day and thermal cameras, a multi-functional digital driver dashboard and wide-angle optical periscopes for the driver.



## HUNTERS OF LAND AVIATION ATTACK HELICOPTERS

Mehmet KOÇTUĞ 🖈 Defense Researcher

M5 DEFENCE MAGAZINE 2024

ttack helicopters have played a major role in the battlefield over the years. These roles have been shaped by close air support in general. When the iconic attack helicopter design and use are evaluated, its effectiveness is clearly understood. The body structure, designed to carry more weapons and to maneuver precisely, stands out on many platforms compared to helicopters used for transportation purposes.

This article will discuss the aircraft's evolving features, in particular, the main armament of the attack helicopters: nose guns. Although manufactured in variable calibers, the installed guns mainly use 20 mm and 30 mm ammunition. Apart from the cannon installed on the nose, stub wings are also included in the specialized designs of attack helicopters. Using blades to achieve a vertical takeoff instead of wings, the aircraft utilizes a modified, shorter version of this structural element to carry weapons. Just like in warplanes, ammunition is carried in weapon stations on the attack helicopter's wings.

Attack helicopters have a war strategy focused on land-based engagements. In addition, there are applications for integrating surface-to-air munitions and short-range air-to-air missiles into attack helicopters used for MANPADS. The ability to attack land targets, the main engagement element, with unguided rockets is one of the prominent features of attack helicopters. Though they use rockets as unguided munitions, the wide application of unguided bombs is not available in attack helicopters. The rockets are often carried in multiple rocket pods. These systems enable attacks on helicopters involving rocket salvos in which ammunition is fired in rapid succession.

Besides unguided munitions, guided munitions are also one of the aircraft's main striking elements. These munitions are armor-piercing, like antitank guided missiles (ATGMs). As mentioned above, attack helicopters, which are one of the basic elements of close air support, often take the lead for troops advancing from the ground by employing guided anti-tank munitions. Uninterrupted burst firing capabilities via the nose cannon and rocket pod enable attacks that will result in massive suppression of enemy elements. Along with providing air support to a fighting unit, accompanying the troops in transit is also an important task for attack helicopters. In sudden ambush situations, they can respond quickly, suppress the ambush and give the troops in the convoy time to take precautions.

Besides being aircraft with advanced technologies, these machines work directly in the middle of the hottest conflicts of the war. An advanced warplane can attack targets on the ground from a height of hundreds of meters and can perform duties without encountering many threats from the ground.

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The story of the helicopter started at the beginning of the 20th century and continues to gain pace today. The initial goal was, of course, to be used as an easy solution for transport, and armies quickly recognized the versatile capabilities of this vehicle.



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However, attack helicopters operate in a position open to many threats at very low altitudes. Many tactical and advanced systems have become a part of the operational concepts of these platforms to operate under these conditions.

Although there are several models with various ammunition-carrying capacities, we are familiar with the general image of an attack helicopter. The familiarity here includes a fuselage that blends majesty and agility with pilot cabins positioned back-to-back, stub wings loaded with ammunition and a nose with a machine gun. However, the helicopters mentioned in this article may vary with certain features or will include non-generic features not previously listed above and are specific to that platform.

#### AH-1

The attack-oriented model of the AH-1 helicopter family, the AH-1, emerged amid the conditions of the Vietnam War. The extensive use of UH-1 helicopters to transport infantrymen in Vietnam has brought with it the need to defend these helicopters. Helicopters used by infantrymen while deploying to the battlefield faced many variable situations in which they were vulnerable during the execution of these logistics missions. First, the UH-1s, which were traveling at low altitudes during deployment, were targeted by intense fire from MANPADS and anti-aircraft systems. In this situation, logistics elements such as the UH-1 were weak in terms of avoidance and response mechanisms. The machine guns placed on the gates were also largely unable to respond to such attacks. Likewise, the rocket pods attached to the added weapon stations were also inefficient.

In addition to the threats encountered during the deployment, the need for a special platform for close air support emerged in Vietnam. The armament of the UH-1s did not offer a superior performance in this regard.

Due to the need for close air support and protection of the elements in transit, the first studies were put forward that gave shape to today's attack helicopters. The AH-1 helicopter, which emerged in line with these demands, is a helicopter specialized in maneuvering capabilities and weapon-carrying capacity.



Attack helicopters have a war strategy focused on land-based engagements. As a result, its gun and underwing weapon systems are designed for land targets.





The AH-1 does not have a payload compartment like transport helicopters. In addition, the positioning in the cockpit at the front is not side by side, but back to back. In this way, both pilots are presented with a perspective that dominates the environment. The tandem cockpit structure, which is generally seen in attack helicopters, provides a suitable perspective for the personnel with two different duties in the helicopter. One of the two personnel is responsible for the navigation of the helicopter and the other is responsible for the weapon system. This type of cockpit design will be encountered in most of the helicopters mentioned in the following headings.

The term "tandem" is generally used to describe the situation of sequencing. Tandem warheads are another common element. Here again, the intent defines a cascade of two different warheads with the main purpose here being to achieve effective results against armor with reactive armor plates. The first warhead is effective on the first armor plate, while the second warhead positioned behind is used to penetrate the main armor. Another striking element in terms of structure is that the AH-1 helicopter has stub wings just like other attack helicopters. These wings are smaller compared to the fuselage than to those seen on an airplane because their main purpose is to carry weapons, not to provide lift to the helicopter.

While the first AH-1 helicopters were single-engined, a twin-engine design was adopted with the improvements made to the helicopter. There are versions of the helicopter, which first appeared in the Vietnam War, still in use. It would be useful to examine the AH-1W Super Cobra and AH-1Z Viper models to better discuss their current capabilities.

A basic comparison between the W and Z models of the AH-1 will reveal significant performance gains. The Z model has an enlarged wing structure that can carry more weapons. In addition, the number of blades in the main and tail rotors has been increased from two to four. In addition to these structural changes, many common weapon systems are used in both helicopters.

Versions of General Electric's T700 turboshaft engine, which is used in many helicopters, are used in helicopters. Turboshaft engines are located at the top of the helicopters. As with other gas turbine systems, a spindle work is produced by the air flow. However, turboshaft engines have a mechanism suitable for distributing this shaft work to other systems in the helicopter. The main driving elements are the main rotor and tail rotor. These rotors operate in a certain rotational pattern and provide the movement of the helicopters. Rotors rotate by transferring the shaft work from the turboshaft engine with various joint and gear systems.

Considering the general mechanics of the helicopter, the main rotor does the work necessary for gaining altitude. Since it rotates at very high speeds and is too large compared to the general geometry of the helicopter, an additional element is required to position the helicopter unsupported in the air and to ensure the orientation of its nose. This is where the tail rotor comes

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Continuous rapidfire capabilities with the nose cannon and rocket pod allow for attacks that will result in massive suppression of enemy elements.

into play. The tail rotor also rotates via the turboshaft, just like the main rotor. While rotating, it balances the effect of the main rotor to stabilize the aircraft.

Two major issues arise in this mechanical equation between the main and tail rotors. First, the turboshaft engine adds complexity and complications to the system, which is required to run for long periods. The second issue is the risk posed by the tail rotor. When the images of the helicopters shot in the tail rotor are examined, it is clear that a dysfunctional tail rotor overrides the pilot's control over the platform.

In weapon systems, there is a general configuration on the platform for land targets. The M197 cannon, which uses 20 mm ammunition as a nose cannon, is used in addition to the BGM-71 TOW ATGM, AGM-114 Hellfire guided airto-surface ammunition, 70 mm Hydra rockets and AIM-9 Sidewinder shortrange air-to-air missiles. Hydra rockets can be used in configurations of seven or 19 pods. In addition, this ammunition can be used as guided ammunition with a modular structure. Called the Advanced Precision Kill Weapon System (APKWS), this add-on can be thought of as the addition of a guidance kit to the standard 70 mm ammunition. It has a similar structure to the guidance kits designed for the standard free-falling Mk-80 series bombs. The length of the ammunition is increased without changing the diameter. The guidance kit increases the accuracy of shooting while aiming at the target with the wings opened after launch.

AIM-9 ammunition can be carried one on each flank and is usually used for self-defense. With the increase in ammunition-carrying capacity in helicopters over the years, the AH-1 has remained in the relatively light class but is still used today. The U.S. Marine Corps actively uses the AH-1Z Viper.



The Turkish Armed Forces also use AH-1W Super Cobra helicopters on the TCG ANADOLU LHD.

#### **AH-64 APACHE**

The AH-64, the attack helicopter included in the inventory by the U.S. after the AH-1, stands out with its more advanced weapon-carrying capacity and qualified electronic subsystems. It can also carry a wider variety of ammunition than the AH-1.

The AN/APG-78 Longbow fire control radar, which started to be used after the D model of the AH-64 helicopter, has superior capabilities. The radar, whose capabilities have increased with many improvements since the D model, can track up to 256 fixed or moving targets. This radar, which can engage 16 targets at the same time, can also exhibit advanced capabilities in sea conditions. It can perform tasks such as determining the exact location of the detected targets and classifying them. The radar is located at the top of the main rotor.

Electronic developments after the D model have increased the interaction of the helicopter with the unmanned elements around it. It can interact with unmanned aerial vehicles jointly with ground-based control stations. Also, considering the Longbow radar, the AH-64 can be considered a platform that collects a lot of information about the battlefield. It can collect information related to targets and transmit this information to friendly elements with which it carries out joint operations.

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Along with providing air support to a fighting unit, accompanying the troops in transit is also an important task for attack helicopters.

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AH-64s have targeting and night vision systems in the nose. The ball is still positioned under the fuselage but slightly further back. Optical systems in the nose are called TADS (Target Acquisition and Designation Sights) and PNVS (Pilot Night Vision System). These two systems are independent of each other. The TADS system has a laser target marker. At the same time, both the TADS and the 30 mm cannon are aimed in the direction the pilot is looking at, thanks to the helmet. The PNVS positioned above the TADS provides night vision to the pilot.

It has a different ball system compared to the AH-1. The M230 automatic cannon, which uses single-barreled 30 mm ammunition instead of a multi-barrel, is used in the AH-64s. It performs its duties with an ammunition capacity of 1,200 units. Spike ATGM capability against ground targets is also available on the AH-64. AIM-92 Stinger ammunition is also used against air targets. This ammunition, which is used as MANPADS on land, can also be transported in helicopters. Production of the AH-64 is expected to cease by the 2030s. In this context, the U.S. is turning to innovative platforms such as RaiderX. At the AUSA 2022 fair in the U.S., improvements in the wings of the helicopter were presented. With this latest innovation, an AH-64 configuration with increased weapon-carrying capacity is planned.

#### AW249

The platform, which made its first flight this year, is the stage where Leonardo came after the AW-129 Mangusta. Compared to its predecessor, it is expected to house the developing products of the Italian aviation electronics industry in its wider body. In the images published about the test flight, the TM197B cannon, which uses 20 mm ammunition, was seen. This Gatling gun system includes the turret system developed by Leonardo, which uses the M197 gun we mentioned in the advanced models of the AH-1. Although the helicopter, which is compared to the AH-64 in terms of its dimensions, has a lower caliber gun instead of the 30

mm gun, it should not be forgotten that the platform is still in the testing phase. French Rafael's Toplite observation and targeting system also appeared in the tests, mounted on the machine gun in the nose.

Although the first tests do not clarify the weapon capacity of the platform, it can be said that the main purpose is to obtain a wider body ready to be equipped with new subsystems. The fact that the body of the predecessor Mangusta model is no longer suitable for further development explains the need for a wide body.

As mentioned in the AH-64, advanced interaction capabilities with unmanned

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The M230 automatic cannon, which uses single-barreled 30 mm ammunition instead of a multi-barrel, is used in the AH-64s.



aerial vehicles are expected on this platform as well. Thus, an attack helicopter with a more integrated structure for the battlefield will emerge. Among the systems expected to be in the AW249 is the Quiris DIRCM (Directional Infrared Counter Measures) system. The DIRCM is a self-defense system used against infrared-guided ammunition. Applications for such systems are just emerging. The first application areas are expected to be platforms with low self-defense against air defense systems such as aircraft and helicopters used for transportation purposes.

#### **T129 ATAK**

The contract for the T129 ATAK, the product of the ATAK Project initiated for the needs of the Turkish Armed Forces, was signed on Sept. 7, 2007, and entered into force on June 22, 2008. Selected as the main contractor within the scope of the project, TAI started the process of developing and redesigning the A129, designed by the main subcontractor AgustaWestland (today Leonardo), according to the needs of the TAF. In addition to replacing the engine, powertrain and tail blades



between the two platforms, the helicopter was equipped with national avionics and weapon systems. Designed for close air support missions and multi-purpose missions, the T129 ATAK is optimized to handle "hot air high altitude" missions with its heavy weapon load. The newly produced ATAK hulls replacing the obsolete AH-1 hulls strengthened the force's hand in the attack helicopter and extended the life of the fleet.

In addition, with its advanced fire control systems and ammunition, it has become an indispensable element of counterterrorism operations as a much more effective platform. In this regard, a platform that we have much more control over from operation to production has been put into the service of our army. Regarding the prominent features related to ATAK, it would be useful to first mention the Avcı Helmet Integrated Control System developed by ASELSAN as a very important tool in the pilot's control system. Therefore, it can be integrated with many different systems.

It should be noted that data is processed in the visor of the helmet, as in the cockpit displays. In this way, the pilot's awareness of the helicopter's controls increases. In addition, it is possible to direct the ammunition or the machine gun according to the head movements of the pilot. We did not have this feature, which appears as an element that increases the accuracy of

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Although the helicopter, which is compared to the AH-64 in terms of its dimensions, has a lower caliber gun instead of the 30 mm gun, it should not be forgotten that the platform is still in the testing phase.



shooting, in attack helicopters before the Hunter was used in T-129s.

The system that enables Avcı to work effectively in this way is ASELSAN's ASELFLIR 300T Electro-Optical Reconnaissance, Surveillance and Targeting System. The images captured by this system, which is positioned right above the machine gun on the nose, are also displayed in the helmet.

The weapon systems in the T-129 are largely made up of domestic ammunition. Sarsılmaz is carrying out a project related to the 20 mm automatic cannon. The system, whose tests are still ongoing, is expected to be delivered soon. The weapons of the platform, which can use the ammunition of Stinger MANPADS, are generally aimed at land targets. Up to eight UMTAS-guided antitank ammunition can be loaded. 70 mm rockets, which have become standard in attack helicopters, and guided CİRİT ammunition of the same caliber are among the ammunition used.

The electronic warfare capabilities of the helicopter have also been improved

with the latest development package, which is described as ATAK Phase-II. Helicopters in this configuration are equipped with advanced missile warning, infrared countermeasures and radar frequency jamming systems. Thus, the self-defense capabilities of the platform in direct combat on the front line have been increased.

A process similar to Leonardo's transition to the AW249 after Mangusta is also underway for the ATAK helicopter. The project, called ATAK 2 or T-929, is progressing, as the fuselage is now too small for new developments.

#### **EUROCOPTER TIGER**

The Tiger is a co-production helicopter. It started as a joint project between France and Germany. It is designed in accordance with the variable job description. It has various armament configurations according to these mission definitions.

For anti-tank assault missions, it is deployed with an array of weapons made mainly of guided munitions and can engage armored vehicles with eight Hellfire or Spike-guided ammunition loads. In addition to these, four Mistral air-to-air guided ammunition are loaded for air defense. It also uses the 30 mm nose cannon with armor-piercing rounds, especially against lightly armored vehicles.

For close air support, it works with a weapon load of unguided rockets. It carries 68 68 mm rockets or 52 70 mm rockets in rocket pods on its wings. Its main weapon, the 30 mm nose gun, is functionally used in this configuration.

Accompanying transport helicopters on the battlefield is one of Tiger's most

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Designed for close air support and multipurpose missions, the T129 ATAK is optimized to handle "hot air high altitude" missions with its heavy weapon load.



important duties. This model supports the safe delivery of logistics on the battlefield. For this mission, a hybrid armament was used to counter various threats. Two Mistrals are loaded into a single-wing weapon station for air defense. Thirty-four pieces of 68 mm or 26 pieces of 70 mm rockets, four Hellfire or Spike missiles and 30 mm nose guns are loaded to combat threats from the land. For armed reconnaissance, it operates with four Mistral, 44 68 mm or 38 70 mm rockets and a 30 mm cannon gun load.

#### **MI-24**

Mi-24 combines attack helicopter and transport helicopter characteristics. The hull of the helicopter can be used for transport. However, the tandem cockpit structure, which is common in attack helicopters, accompanies the cargo compartment. The reason for this is that the design of the helicopter aims to ensure that both soldiers can be

> Accompanying transport helicopters on the battlefield is one of Tiger's most important duties. This model supports the safe delivery of logistics on the battlefield.

transported and close air support can be provided. Thus, it was possible to perform both tasks with a single platform. However, many parts of the helicopter's initial design were transferred from the Mi-8 helicopter. Having common subsystems with this helicopter, which was widely used in the Soviet Union, and being a platform that can perform many tasks, it has found a use in a wide geography.

The cockpit of the prototypes was changed over time. While it was initially covered with flat glass, it gained its present appearance with new designs. In addition, in the first models, the ball is fixed to the body. This required the nose of the helicopter to point toward the aiming direction to aim. In the following process, a cannon design placed in a turret under the nose was adopted.

The export model of the Mi-24D version was named Mi-25. Mi-35 is the export name of the Mi-24V model. Highcaliber rockets have drawn attention to the armament of the Mi-24V. Another noteworthy feature is that free-falling bombs can also be used. At the weapon stations on the wings of the heli-

copter, 57 mm S-5, 80 mm S-8, 122 mm S-13 and 240 mm S-24 rockets can be mounted. It uses the Shturm as guided anti-tank ammunition. The four-barrel Yak-B Gatling gun, which uses 12.7 mm ammunition, is used in the turret, which is placed in the nose of the helicopter.

#### **MI-28**

Unlike the Mi-24, MI-28 is a purebred attack helicopter with no cargo function. It has been in service since 2009. The project, which started in the Soviet era, was interrupted by the disintegration of the Soviet Union. The political and economic problems experienced afterward disrupted its production. It has a 30 mm Shipunov 2A42 automatic gun as a nose gun. It works with 250 ammunition. Its air munitions are Igla-V MANPADS ammunition and R-73 air-to-air missiles. An interesting feature of the Mi-28 helicopter is that it can launch rockets with a high caliber of 122 mm. It uses 122 mm caliber S-13 and 80 mm caliber S-8 rockets. Along with these, Atak-V carries Vikhr and Khrizantema-guided antitank ammunition.

#### KA-50/52

Kamov is a Russian company that produces helicopters with Coaxial Rotor technology for various missions. The helicopters produced by the com-

KA-52



pany are generally deployed on ships for military purposes. These helicopters, which are used for electronic warfare, anti-submarine warfare and logistics missions, are far from being attack helicopters. The Ka-50 design put forward by the company is a model that blends the coaxial rotor and the attack helicopter concept. An interesting helicopter in many ways, the Ka-50 is available in models with three different cockpit designs. The Ka-50 is a model with a single pilot cockpit. The Ka-50-2 Erdoğan model, on the other hand, is a model with a tandem cockpit. This model is Kamov's work with IAI (Israel Aviation Industries). Such a design was made to meet the demands of Türkiye's helicopter tender, but the

> An interesting feature of the Mi-28 helicopter is that it can launch rockets with a high caliber of 122 mm.

project did not enter mass production when the tender was not received. Later, the firm Kamov asked the chief of design to make a modified version of a Ka-50 that could take on this task. The "Black Shark" version was chosen for this. And the idea of side-by-side seating was decided upon by the crew members. Thus, this double-seat version was named the Ka-52.

Compared to the Ka-50, the Ka-52 has a softer nose profile, a mast for air targets, two antennas mounted on the nose for ground targets, two spherical turrets, one above the cockpit and the second under the nose, and a day and night TV/thermal sighting system is also mounted and features the sidemounted cannon of the original Ka-50. The number of wings, which are four in the Ka-50, has been increased to six in this model. To keep weight and performance on par with the Ka-50, the armor and capacity of the gun magazine/feed have been reduced. In addition, the helicopter is approved for day, night and adverse weather conditions. However, some problems occurred in the helicopter: the climb rate decreased from 10 to 8 m/s and the maximum positive load factor was 3.0 g. These problems were eliminated with the VK-2500 model.

#### WZ-10

Also known as CAIC (Changhe Aircraft Industries Corporation) Z-10, this relatively light-class assault platform is an armed reconnaissance helicopter. The first designs of the helicopter were made by Russian Kamov. The production of the prototype was made in Russia, then the development activities and manufacturing were shifted to China. It has a canon that is directed according to the head movements of the pilot. It can use guns in two different calibers, 23 and 25 mm. As unguided rockets, ammunition of variable caliber between 30 and 130 mm can be carried in rocket pods on the wings. TY-90 and PL-9 air-to-air munitions also form the helicopter's air-guided munitions capability. It can use HJ-8 and AKD-10 guided anti-tank munitions against land targets.




he battlefield includes numerous variables and entails different requirements.

A wide variety of products is needed for field personnel to counter variability in the field. For example, in operations where the combat distance is reduced to a few meters, such as residential operations, short-barreled, low-recoil products are preferred. while long-barreled, high-caliber weapons are preferred in field operations where the combat distance increases to dozens of meters. SARSILMAZ Silah Sanayi has set out to meet every need of Türkiye, especially the Turkish security forces, as well as friendly and allied countries, and is fulfilling this goal with uniquely designed products. Founded in the 1800s, SARSILMAZ currently owns the largest arms factory in Europe. Development, testing and production activities of many weapon systems, from anti-aircraft guns to infantry rifles, from machine guns to pistols, are carried out in SARSILMAZ facilities, which consist of 100,000 square meters of enclosed and 35,000 square meters of open space. The following are some of SARSILMAZ's products of various calibers, many of which are currently successfully used in the field.

> SARSILMAZ Silah Sanayi has set out to meet every need of Türkiye, especially the Turkish security forces, as well as friendly and allied countries, and is fulfilling this goal with uniquely designed products.



#### READY FOR MISSIONS IN EVERY FIELD: SAR 127 MT

SARSILMAZ's current highest caliber product is the 12.7x99 mm caliber SAR 127 MT. SAR 127 MT, produced entirely with SARSILMAZ engineering, is in the anti-aircraft category. Antiaircraft guns have been continuously used against air, land and sea targets since the day they emerged.

Produced to provide the strong fire support needed in active combat, the heavy machine gun SAR 127 MT can operate fully automatically and fire single shots.

SAR 127 MT had integrated and adapted to remote-controlled systems or the position it is placed in thanks to its cannon ammunition feeding that can be done from the right or left. The effective range of the SAR 127 MT, which can be mounted on land, sea and air vehicles via interface connections, weighs approximately 38 kilograms (84 pounds). It can reach 1,830 meters for regional targets, while its maximum range is up to 6,764 meters. Capable of firing 600 rounds per minute, SAR 127 MT also has a quick barrel change (QCB) feature. SAR 127 MT AIR, the air version of SAR 127 MT, is also developed by SARSILMAZ. It has a fixed barrel, is equipped with rapid cooling elements and lightened internal parts, and can make a higher rate of fire than the land version. SAR 127 MT AIR can make 900-1,250 beats per minute with mayon feeding. The heavy machine gun, with its muzzle velocity of 890 meters per second, is the most suitable option for air platforms with its maximum length of 1,610 millimeters, barrel length of 915 millimeters, height of 160 millimeters and weight reduced to 33 kilograms.

SAR 127 MT AIR is also being used with the gun pod developed by TR Mekatronik, of which SARSILMAZ is a subsidiary together with Turkish Aerospace Industries (TAI), one of Türkiye's largest defense industry organizations. The weapon will be installed on Hürkuş-C close air support aircraft produced by TAI. The system's qualification tests are ongoing and being conducted by SARSILMAZ and TR Mekatronik. It can be used on all types of aircraft and naval platforms when necessary.

### SAR 127 MT TECHNICAL SPECIFICATIONS:

#### Caliber

12.7x99 mm (50 QCB)

Barrel Length 1,143 mm (45")

**Total Height** 190 mm (7.5")

**Functional Principle** Short Blowback Type

**Firing Mode** Full Auto

**Total Length** 1,655 mm (65.1")

**Unloaded Weapon Weight** 38,100 gr (28.4 oz)

Muzzle Velocity 930m/s (±50mm)

#### **Rate of Fire**

600 shots/min

## SAR 127 MT AIR TECHNICAL SPECIFICATIONS:

Caliber

12.7x99 mm

**Barrel Length** 915 mm (36.0")

**Total Height** 160 mm (6.2")

**Bullet Capacity** M9

**Firing Mode** Full Auto

**Total Length** 1,610 mm (63.3")

**Unloaded Weapon Weight** 33,000 gr (1,164.04 oz)

**Muzzle Velocity** 890 m/s

**Rate of Fire** 900-1200 Rounds

#### VERSATILE FAMILY WITH MODULAR DESIGN FOR EVERY TASK: SAR 762 MT

Another machine gun produced by SARSILMAZ is the SAR 762 MT. This 7.62x51 mm caliber machine gun provides intense firepower. SAR 762 MTs have started to be delivered to Turkish security forces and are actively used in the field. The belt-fed, air-cooled and short-recoil SAR 762 MT is a family that can be used with many elements, from infantry to on-platform gun turrets. There are five members of the SAR 762 MT family, which features a trigger system with an open-position, gas-actu-

SAR 127 MT can be easily integrated and adapted to remote-controlled systems or the position it is placed in thanks to its cannon ammunition feeding that can be done from the right or left.





– Trigger Assembly

- Bolt Assembly

- Buttstock Assembly
- Bipot Assembly

Capable of operating at temperatures between minus 52 and 72 degrees Celsius (minus 61.6 and 162 degrees Fahrenheit), the effective range of SAR 762 MT for regional targets is 1,200 meters, with a maximum range of 3,725 meters. The average weight of different models is 12 kilograms. The SAR 762 MT family consists of five members. SAR 762 MT-A can be used in remote-controlled weapon systems (UKSS). The SAR 762 MT-B model, developed for infantry use, can be fired both from a bipod and tripod. The SAR 762 MT-C is intended to be used as a co-axial machine gun in both wheeled and tracked armored vehicles. The fire rate per minute of SAR 762 MT-D, which has similar features to SAR 762 MT-B, can be changed thanks to the three-position gas valve. The last member of the family, SAR 762 MT-E, can be used in marine vehicles with its corrosion-resistant design.

#### TURKISH COMMANDO RIFLE: SAR 56

SARSILMAZ, which met the need for intense firepower with machine guns, also rolled up its sleeves for infantry rifles. In this context, the original design of the SAR 56 infantry rifle was produced with SARSILMAZ's own engineering power. The 5.56x45 mm caliber SAR 56 offers high performance with its short-stroke gas piston system and provides easy use with its five-position, cheek-supported buttstock. The ergonomic design of the SAR 56 is enhanced by its long and detachable fore-end as well as its angled hand grip.





ated operating principle. Offering more shooting opportunities with its QCB, all models of the SAR 762 MT have a barrel life of at least 25,000 shots. The QCB is crucial for uninterrupted fire support in extended battles, allowing personnel to replace the heated barrel in the field during active engagements. The SAR 762 MT can use the 7.62x51 mm NATO standard M80 cartridge, which fragments during feeding, and the 7.62x51 mm NATO standard steel core (M61), tracer (M62) and maneuver cartridges as special ammunition.

SARSILMAZ used its superior engineering power to achieve maximum use during the development phase of SAR 762 MT. As a result, the rifle can be easily used in infantry, land, sea and air platforms.

SAR 762 MT consists of eight main assemblies (functional elements) that can be customized according to user preferences:

- Body Assembly
- Barrel Assembly
- Mechanism Assembly
- Top Cover Assembly



Since the gas port used by SARSILMAZ in the SAR 56 is very thin and light, it does not affect the natural resonance of the barrel and thus more accurate shots can be made.

Again, since the mechanical parts of the rifle are aligned with the barrel, the recoil of the weapon are quite low. As a result, the possibility of shooting quickly and accurately increases even more. In addition, several optical systems can be attached to the rifle's Picatinny rail. SAR 56 can be secured even when it is not installed, priori-

> SAR 56's barrel length options include: 7.5 inches, 11 inches and 14.5 inches. SAR 56 stands out as a solution suitable for all missions and conditions, from close to long range.

tizing stability with a structure compatible with tactical use thanks to its double-sided latches. Other important features of the SAR 56 include its polymer dust cover, ergonomic belt connection ring and magazine with quantity indicator. Another important feature of the SAR 56 is its barrel length options: 7.5 inches, 11 inches and 14.5 inches. SAR 56 stands out as a solution suitable for all missions and conditions, from close to long range. The rifle can be produced in a variety of colors in accordance with user preferences. SAR 56 is currently used by the Turkish Special Forces, Turkish commando troops, Turkish gendarmerie and the police force.

#### LIGHTER WITH SHAKE-PROOF SOLUTION: MPT 76 SH

SARSILMAZ, one of the few companies that undertook the mass production of the national infantry rifle MPT 76, Türkiye's first domestically produced infantry rifle, carried out studies to reduce the weight of the 7.62x51 mm caliber weapon. In this context, by using completely domestic resources and adhering to the performance criteria, the rifle was lightened by 470 grams and named MPT 76 SH. Using 7.62x51 mm NATO standard ammunition, MPT 76 SH is fed by a magazine with a capacity of 20 bullets. MPT 76 SH, which can reach a muzzle velocity of 800 meters per second, has an effective range of 600 meters. It was also developed with several accessories thanks to its modular railed handguard.

#### **REBORN LEGEND: SAR 15T**

SAR 15T is one of SARSILMAZ's newest products and is based on the legendary AK-47 platform.

It is a modernized version of the picatinum, 100% locally produced by SARSILMAZ, with its top cover, lower and upper fore-ends, and rails. Currently used by the Turkish Armed Forces (TSK), the SAR 15T stands out as a much lighter infantry rifle than





its counterparts while offering a modern design with its high-strength polymer magazine, stock and fore-end reinforced with steel parts. With its five-stage foldable stock and superior performance in all climatic conditions, SAR 15T provides its user with the advantage of comfortable carrying. This legendary infantry rifle, which has a caliber of 7.62x39 mm, offers single and rapid-fire options while operating with its long stroke gas piston-driven system.

#### ESSENTIAL TOOL FOR CLOSE RANGE: SAR 109T

SAR 109T, originally designed by SARSILMAZ for close-range combat, from residential operations to enemy ship capture, draws attention with its lightness and easy-to-use features. Thanks to its high-speed operating

> SAR 109T also enables the use of accessories that may be needed on the battlefield with its modular body structure designed according to NATO standards.

capacity, it is extremely effective. SAR 109T also enables the use of accessories that may be needed on the battlefield with its modular body structure designed according to NATO standards. Working with a blowback system, SAR 109T can fire approximately 900 shots per minute. The submachine gun can be fed with a magazine with a capacity of 30 bullets. It has a dioptric (50-100 meter) folding and adjustable mechanical sight that enables fast aiming. In addition, the length-adjustable telescopic stock reduces rearward thrust by transmitting the recoil directly to the shoulder thanks to its linear structure. SAR 109T is actively used in the field by the Turkish Armed Forces, Turkish gendarmerie and Turkish police, and also has a carrying handle version.

#### SPECIAL OPERATIONS HANDGUN: SAR9 SP

Along with machine guns and infantry rifles, SARSILMAZ has many types of handguns.

One of these pistols is the SAR9 SP, a member of the SAR9 family with the world-famous 9x19 mm caliber. SAR9 SP has a polymer frame and a steel barrel. While the weapon has all the superior features of the SAR9 family, it also draws attention with its technical capabilities that meet different and specialized needs. Offering safe and practical use, the gun has a firing pin and trigger safety as well as a high fixed front sight. SAR9 SP also includes upgrade options with a silencer mount, magwell and safety loop. The pistol has a total length of 211 mm and a height of 152 mm. It weighs 850 grams and its barrel length is 133 mm. It is used by the Turkish Special Forces.





# The Military's Premium Elite SPECIAL FORCES

M. Ali Mecdiyeli 🛧 Defence Researcher

thenian historian and general Thucydides, in his book "The Peloponnesian War," said that militaries can face traces of several elements, including civil wars, low-intensity conflict and guerrilla methods, in addition to conventional wars depending on the battle being fought. Historical references such as these confirm that the basic characteristics of conflicts have existed for centuries.

Though some aspects of war, including techniques and advancements in technology, have changed, the spirit and drive of the soldiers have remained steadfast. According to Aristotle, military service, one of the oldest professions, was strategically important for the survival of the state. He observed that the real leaders of society were soldiers, statesmen, senior administrators and property owners. He also pointed out that good administration requires an effective army, which consists of well-trained soldiers who are ready to sacrifice themselves when necessary within a systematic order and tradition.

The questions of why wars break out and how they are conducted are just as important as the question of what war is. The widely accepted view is based on Prussian Gen. Carl von Clausewitz's aphorism, "War is the continuation of politics by other means." In other words, war is a different tool of politics. The political goal of war is to impose the party's will on the enemy. The military goal of war is to destroy the enemy's will to fight. In our previous articles, we have made various comments and statements about war and general war types, including some paradigms. These paradigms included the concepts of national power, politics, war, orderly war, conventional war, strategy, unordered war and unconventional war. In its most basic form, warfare is divided into two categories: regular and irregular. Therefore, soldiers will be divided into regular and irregular accordingly.

This month, we will focus on the role of special forces soldiers, the unsung heroes of unconventional warfare who wrote their epics silently and with unwavering devotion.

First, I would like to wish God's mercy on all our martyrs who sacrificed themselves without hesitation and to all our heroic veterans who bravely gave their lives for their country. I also wish a healthy, long life to all our living veterans. In the general sense of strategy, the necessary planning to achieve the goal and the implementation of a plan lie in the continuous use of the most common form of war and the elements of unconventional warfare, which are meant to maintain this position in the future as part of an effective strategy.

Conventional warfare is generally used to describe wars fought with common and conventional military equipment, minus nuclear weapons. Likewise, both sides are waging the war with regular armies. In addition to nuclear weapons, biological and chemical weapons 66

Special forces units specialize in unconventional warfare and are mainly composed of soldiers trained to serve in unconventional wars, are highly skilled in warfare, are resilient and have an especially strong determination to never give up.

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are also excluded from conventional warfare. With the use of nuclear weapons in World War II, the world entered a new era. Due to the risk of mutual extinction, states with nuclear weapons, in particular, had to follow different methods of solving problems. At this point, in addition to the conventional regular units, elite special forces units also emerged.

Special forces units are mainly composed of soldiers who are trained to serve in an unconventional war, are highly skilled in warfare, are resilient and have an especially strong dedication. Special forces' specialty is unconventional warfare. The difference from conventional wars is that it is fought without regular large troop units. The struggle is generally carried out based on people and legitimacy.

The following elements stand out as the main characteristics of irregular warfare tactics: It is carried out by small groups; nonconventional small operations have cumulative effects; secrecy is at the forefront and the aim is to achieve not only military victory but also a political victory. In the end, in unconventional warfare, the main aim is not absolute victory but attrition and gaining time.

This attrition may be to gain time until the arrival or regrouping of the main troops, preparing the appropriate envi-



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ronment or dragging the enemy into intimidation. The term "unconventional war" is defined in the U.S. Army's dictionary "Department of Defense, Dictionary of Military and Associated Terms" as "the violent struggle between state or non-state actors for legitimacy and sphere of influence over the population concerned."

Irregular warfare is excluded from regular wars in the post-Westphalian nation-state system. In this respect, it differs from conventional warfare. Unconventional wars were often labeled "small wars" in the literature because the goal was to assist regular forces and the overall war efforts. As a result, the tendency of states to view unconventional warfare in this light is also shared by the people.

Unconventional warfare can sometimes be perceived as illegal, against human rights or unlawful. The underlying reason for this perception is that this type of war includes methods outside conventional methods. Legitimate states can also utilize this method, provided that they remain within the law.

Special forces are the units states use especially for unconventional warfare. Chinese strategist Sun Tzu's idea of winning wars without engaging in heavy fighting is still of particular importance today. If a country's special forces units can be directed to targets in coordination with the country's national forces, the result will likely mirror Sun's effective approach.

#### SPECIAL FORCES CONCEPT

Special operations military activities carried out by specially designated, organized, trained and equipped forces using operational techniques and forms of engagement that are not standard to conventional forces constitute the concept of special forces. These activities are carried out in all military operations, either independently or in coordination with the operations of conventional forces, to achieve political, military, psychological and economic objectives. Politicalmilitary considerations in these operations may require covert techniques and acceptance of a degree of physical and political risk unrelated to traditional operations.

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Military activities carried out by specially designated, organized, trained and equipped forces manned by select personnel, using unconventional tactics, techniques and forms of employment are considered special forces activities. Although the concept of special forces has a very important place in the military literature and a deeprooted history, the new threat perception of today's world, the rapid evolution of the current world system toward a multipolar environment, the active, deadly and surprising structure of the new generation wars, hybrid techniques and proxy wars mean special forces have evolved to adapt to the new world order.

The basic duty of special forces units is fairly clear-cut. The type of war conducted with known warfare tactics and regular troops is called an ordinary war. Ordinary war units engage in front-line warfare with the enemy's front-line units. Commando units, which are more elite in terms of combat, endurance and lethality compared to regular units, carry out destructive activities by infiltrating the enemy's close rear from the air, sea or land. Special forces are the units that can work fearlessly and decisively behind enemy lines.

## THE EMERGENCE OF SPECIAL FORCES

There are many historical events and situations that inspired the re-emergence of special forces. In my opinion, the most prominent among them were the "Crazies" ("Deliler" or "Delis"), who served in the Ottoman Army. They would often emphasize phrases like, "Yığıt's level of crazy is acceptable." They fought for the empire from the mid-15th century through the early 19th century.

According to Ottoman historian Ibn Kemal's narrative about the "Crazies": "They would go on an expedition in front of the army, not avoiding the knots during the war, smash the enemy's lines, pierce their battalions, take live captives and provide information about the enemy from them." In a work written by Vecellio, the Venetian writer, in 1550, he said: "They acted so bravely that they convinced people that even their shadows were deadly."

As can be seen, it would be appropriate to identify the courage, boldness and dedication of the Delis in today's special forces. The special Ottoman unit was divided into units of 50 or 60 people, each of which was called a



Special forces consist of units of elite soldiers trained to work without hesitation in all terrains and climatic conditions to eliminate internal and external threats. Their motto is: "We achieve the difficult, the impossible takes time," meaning all challenges will be conquered one way or another. Three aspects are important for special forces personnel: their country, flag and honor. "flag." Several "flags" were combined and placed under the leadership of a commander. The Deli chiefs had lesser-ranking officers under the titles of volunteer chief and company chief. A young man who wanted to be a Deli soldier was first given to one of the hearth lords under the name of "zobu" and brought up, where he learned the methods and rules of the hearth.

After proving himself, he would promise to serve religion and the state and not to run from any fight. Afterward, a uniform cap was placed on his head in a ceremony and he was recorded in the book as an apprentice to the agha. When it was his turn, the young man would become a squire, and even rise to become a Deli soldier. The Deli who did not keep his promise and did not act in accordance with the rules was expelled from the ranks with the removal of his cap and given a felt hat.

In essence, we can compare the traditions, courage, establishment, training and war techniques of the Delis to today's special forces. Here, we should also mention Kür Şad, who raided the Chinese palace with 40 valiant men in 639 to save the Göktürks living under Chinese rule and to kidnap the emperor. The courage and heroism of Kür Şad and his men stand out as one of the most outstanding examples of special forces and also as one of the most surprising events in history.

#### SPECIAL FORCES TEAMS AND THEIR DUTIES

The makeup of special forces units was reshaped at the beginning of the 20th century. During World War II, in particular, they became much more advanced in the field because every major army involved in the war had troops dedicated to special operations deep behind enemy lines.

Throughout the history of warfare, special forces have served effectively to disrupt large units of the enemy through hit-and-run and sabotage via smaller mobile units with high stealth skills, trained to perform in harsh conditions rather than more traditional conventional combat. Other important roles are to provide basic intelligence from nearby or within the enemy territory, and increasingly to deal with irregular forces, their infrastructure and activities.

Special forces also carry out critically important missions, such as air operations, cross-border covert operations, foreign and domestic defense, counter-



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terrorism, counter-insurgency, hostage rescues, manhunts, intelligence operations, etc.

Throughout history, there have been several influential special forces figures. Chinese strategist Jiang Ziya Taigong, who was the commander-in-chief of the Zhou Principality 3,000 years ago, devoted his fifth lesson, called the "Leopard Strategy," to special force warfare techniques and tactics in his book, "Six Secret Teachings." In the "Leopard Strategy," he tackles issues such as combat and resisting a disproportionately small force in difficult terrain and climatic conditions.

The head of the Barca family Carthaginian, commander and statesman Hamilcar Barca (270 B.C.-29 B.C.) had special troops trained to launch attacks at several different points on the same day. Likewise, in the late Roman or early Byzantine period, Roman fleets used small, fast, camouflaged ships full of specialized soldiers for reconnaissance and commando missions. Special forces were employed in various situations in the Middle Ages. An example of this is the special forces of Gerald the Fearless, a Portuguese warrior and folk hero of the Reconquista.

During the Seljuk and Ottoman Empire periods, there were special units trained to gather intelligence, launch raids on the enemy, infiltrate enemy troops, and sabotage and raid behind enemy lines. We can also include Teşkilat-1 Mahsusa, a secret organization established under Enver Pasha within the Committee of Union and Progress and capable of conducting operations.

In Japan, ninjas were used as reconnaissance, espionage and assassins. During the Napoleonic wars, rifle and engineer brigades were formed, which played special roles in reconnaissance and conflict, and were not attached to official battle lines. As history demonstrates, special forces units have fought alongside traditional soldiers with nontraditional methods and served to facilitate the achievement of strategic goals of large units for centuries.

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The Turkish Special Forces were first established on Sept. 27, 1952, under the name Special and Auxiliary Combat Forces. The unit was renamed the Mobilization Inspection Board on Nov. 7, 1953. On Dec. 14, 1970, it was renamed the Special Warfare Department. After the Gulf War on April 14, 1992, due to the emergence of external dangers and new threats from

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U.S. Special Forces units in a MH-6 Little Bird helicopter.

the north of Iraq, its campus and structure were changed in 1992 and it was named the Special Forces Command.

The Special Forces, or Special **Operations Forces**, are military units selected and trained to conduct special operations. Almost every country has its own unit. But what is considered in the personnel selection of these specialized units? First, the candidate must be willing to volunteer. Turkish Armed Forces (TSK) personnel who want to join this elite unit apply with a petition and a personal statement that outlines that they want to voluntarily join the A/B Teams of the Special Forces Command under the General Staff. Candidates are then subjected to a meticulous selection process in which they undergo physical and psychological competency screenings. Only those who pass stringent guidelines are

selected to continue to the next stage of screenings. As part of the process, candidates must obtain a commando and parachute jump report from a fullfledged military hospital. Although they are military personnel, enlisted officers, noncommissioned officers and sergeants applying to the Turkish Special Forces must also undergo security screening and background checks.

Candidates that meet all of the previously listed requirements are then required to participate in an interview. Interviews are conducted by seasoned and experienced senior Special Forces members. If the candidates successfully complete the interview, they are then required to participate in stamina, speed, agility and shooting tests. The tests are not for the faint of heart. The candidates who successfully pass all these stages then start a six-month boot camp, this time under the name of Special Forces Course. The training involves basic principles of special operations, challenging the candidates both physically and psychologically. The slightest hint of a lack of discipline, intolerance, endurance or giving up leads to dismissal from the course and a return to their former position. The success rate of completing this course is approximately 40%. The candidates who successfully complete this course are officially appointed to the Special Forces Command via a sealed envelope during the appointment period.

The appointed personnel are assigned to the A or B Team in any Special Forces unit according to their abilities and skills. (We will skip the details regarding the establishment and administration of the Turkish Special Forces, as the information falls within the scope of intelligence measures. But the procedures mirror those widely used all over the world and are known in open sources.)

Special Forces A Team consists of 12 people, two officers and 10 petty officers. The officers are ranked as Tim K.1 and Tim K. Assistant. Noncommissioned officers, on the other hand, are categorized according to their areas of expertise. They

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are divided into groups of specialists in intelligence, destruction, weapons, combat and medicine. Each team is arranged to be divided into two halfteams of six people when necessary. So, in every half team there is one commander, one intelligence specialist, one destruction specialist, one weapons specialist, one combat specialist and one medical specialist. Therefore, the team can be used independently or as two half-teams, depending on the importance, confidentiality and content of the task, when necessary.

So far, we have briefly mentioned how Special Forces personnel are selected and appointed. Details on who can be a candidate are available in open sources. For the selected and appointed personnel to be considered experienced Special Forces Command personnel, they must work with this unit for at least 10 years. There are national and international specialization courses that must be completed by Special Forces personnel. Being a Special Forces Command member requires self-sacrifice, love of one's country, respect for the flag, love of the nation and full dedication. Anyone who tries to prioritize their own interests cannot work here. There is only one love that comes to the fore here, and that is patriotism. Every person who has received all this training and can work successfully for at least 10 years is a valuable national asset.

In summary, a special forces team is a unit consisting of elite soldiers who have been trained to work without hesitation in all kinds of terrain and climatic conditions to eliminate internal and external threats. The unit's motto is, "We achieve the difficult, the impossible takes time." This means that all difficulties are overcome without hindrance. Three aspects are important for a Special Forces member: their country, flag and honor.



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## LOAD CARRIER OF THE TURKISH ARMY

ERMAD

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hroughout history, logistics power has determined the victor in wars. Armies without fuel, ammunition, and food are vulnerable, regardless of their military might. The critical role of logistical support vehicles in war zones is undeniable. Even when battles occur far from their borders, all armies require functioning supply chains that operate around the clock. These logistical vehicles, the backbone of any military operation, are also the most susceptible to attack. KOLUMAN Automotive Industry has been a supplier to the Turkish Armed Forces since the 1970s. Over the years, the company has delivered thousands of load and troop carrier vehicles to the Turkish military.

In 2016, KOLUMAN leveraged its own internal R&D capabilities to develop an 8x8 logistics support vehicle, which it branded as DERMAN. The DERMAN 8x8 offering ballistic armor protection, a 16-speed fully automatic transmission, and an engine horsepower range of 517–625. The DERMAN 8x8 can operate in off-road terrain conditions, was developed to transport armored vehicles, tanks, ammunition, and command shelters to the operational the-

Mobility



ater, and can recover damaged vehicles. The vehicle, which was exhibited for the first time at the IDEF'19 International Defense Industry Fair, went through an intense testing process. In this context, DERMAN successfully completed the slalom, maximum speed, acceleration, braking, grade ability, side slope, differential lock, fording, run-flat, noise diffusion, and many more tests, proving its compliance with NATO standards.

Supervised by technical teams and observers, DERMAN underwent rigorous testing on specially prepared tracks to ensure compliance with UK, German, and Turkish standards. As part of the contract signed with the Presidency of Defense Industries (SSB), KOLUMAN is delivering 70 DROPS, 70 container transport platforms, 195 ISO 1CC 20-foot containers, and 40 ACV/APC transport platforms, with completion scheduled for 2024. Additionally, prototype work on the Armored Fuel Tanker (Zırhlı AKTAN) version was started. The DERMAN vehicle will be showcased at several important fairs this year, starting with EUROSATORY'24 in Paris. The vehicle will later appear at SAHA EXPO'24 in Istanbul.

In addition, KOLUMAN will participate in SEDEC, TEKNOFEST, SOFEX and INDODEFENCE exhibitions to be held in 2024. At the KOLUMAN booth, an R&D team will be present to provide in-depth information about the DERMAN vehicle. The team will highlight its capabilities and potential applications across these diverse platforms. These events offer an excellent opportunity to learn more about this innovative vehicle and explore potential collaborations.

**USAGE PURPOSES** 

**Recovery Vehicle** 

Fuel Tanker Vehicle

TARGET MARKETS
1. Turkish Armed Forces
2. NATO Countries

3. Other Countries

**Container Carrier Vehicle** 

Tank Transporter Vehicle

Command and Control Vehicle Maintenance and Repair Vehicle

Missile Transport and Loading Vehicle Mobile Air Defense System Vehicle

KEY FEATURES	
Armored / Soft Skin Cabin Option	140 cm Trench and 40 cm Vertical
Single Row / Double Row Cabin Design	Obstacle Crossing Capability
517HP / 578HP / 625HP Diesel Engine Power Option	80 cm Fording Depth Operating Range at -32°C and +55°C
16 Speed Automated	14.00 R20 Off-Road Tires
Transmission	Run-flat Tire System
Up to 29 tons Payload	Central Tire Inflation System
120 ton GCW	Automatic Fire Suppression System
Crew up to 6 Personnel	360° Situational Awareness System
(Including Driver)	NATO Blackout System
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# RUSSIA'S T72 THE END OF A D LEGEND?

MARCH 2024

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In this article, we will take a close look at T-72B3 tanks, one of the main models used by the Russian troops in the attack on Ukraine. In footage from the ongoing war, we mainly see the burned-out shells of this tank. As a result, we will analyze the causes of the problems experienced in the war with the T-72B3 tanks and their possible influence on future strategies.

The T-72 is considered the second-generation tank of the Soviet Union. The T-72, which entered production and development in 1971, was first used in 1973.

In 1967, the design process of the T-72 tanks began. They were designed to prevail on the plains of Eastern Europe against the German Leopard 1 and American M60 tanks, which were put into service in the 1960s, and to protect the mainland of the Union of Soviet Socialist Republics (USSR).

In 1968, the first T-72 prototype, designated "Object 172," was put into service. Due to some problems in 1970, it was redesigned, heavily influenced by the design of the T-64.

On Jan. 1, 1972, a decree issued by the USSR halted the production of T-64A tanks and the Object 172 was put into mass production. Production of the future iconic T-72 tanks, called the Object 172M, began on Aug. 7, 1973, with minor changes made during the preparation phase of mass production.

It is produced by the Uralvagonzavod company, the most advanced machine and tank manufacturer in the Soviet era and also the modern Russian state. As of 2014, the company's revenue had reached around \$6 billion.

The unit cost of the T-72 tank is around \$2.5 million, and it is called the brother of the T-55 Soviet tanks. It is also the older brother of the improved T-90.



The models include the T-72 Ural (June 1973), T-72A (May 1979), T-72M and T-72B (January 1985). In addition, the M series and the modernized T-72 tank, produced under various names, were sent to the former Soviet countries and the Balkan countries.

Variants of the series, on the other hand, include the BMPT support vehicle, the integrated TOS-1 missile launcher system, and the MTU-72 developed with a climbing feature to operate in mountainous regions, especially in difficult geographical conditions. The standard weight of the T-72 is 45-49 tons.

#### MODELS FOR EVERY GEOGRAPHY

The unit cost varies according to the features developed and added. For example, there are differences in weight, merit, and most importantly, price between a T-72 tank sold to North Africa and a T-72 tank sold to the Balkans. The most professional T-72 tanks currently in use are in service in Ukraine and Russia. T-72 tanks continue to be produced in several

variants and models. Orders from various countries are still being received, and the tank, which was recently tested in the Syrian war, has started to find a market for itself.

Russia, the largest supplier of weapons and tanks to the Syrian regime, has brought the T-72 tank to buyers again and had a chance to test the tank by making some modifications to it. T-72 tanks can now track rocket-propelled grenades (RPG) or anti-tank guided missiles (AGTM) with radar and destroy them before they are able to strike.

The images taken in Ukraine are loaded with shots of burnedout T-72 tanks. This tank has been the symbolic name of the main combat vehicles of the Russian army since the Soviet Union. So, what happened to the T72, once a decisive element on the battlefield?





When tanks without radar receive a blow from RPGs, devastating explosions can occur, especially in the ignition and the engine.

Although this is an old idea for tanks, the successful operation of radar and tank technology in Syria, in which Russia is an expert, and the preservation of many tanks in this way has focused attention on this tank again.

#### **T-72 TECHNICAL SPECIFICATIONS**

The tank is 9.50 meters (31 feet) long. It has a classic heavy weapon mounted on the crew part of a 7.62 mm PKT machine gun. It can hold a maximum of 1,350 liters of fuel. Its average speed has increased to 75 kilometers (47 miles) in the latest models. It is designed to travel 620 kilometers without stopping (with full fuel). R&D studies for the engine problems noted and criticized in the past have also been conducted. When tanks without radar receive a blow from RPGs, devastating explosions can occur, especially in the ignition and the engine.

#### USE OF T-72 AND MAJOR PROBLEMS

Its first serious test was against Israeli Merkava tanks during the 1982 Lebanon War. Although it showed teeth against its superior rival, the B modernization was carried out in 1985 to gain superiority against the Merkava tanks and to solve the problems encountered in the field.

T-90 tanks, which form the basis of today's Russian AMT (Main Battle Tank), were developed based on the design of the T-72B.

In this modernization, the 2A46-M gun was installed, the turret protection was increased and "appliqué armor" was added to the front hull armor. The Russians, who first tried an armor design very similar to the non-explosive reactive armor (NERA)-based armor on the T-55 Enigma tank, used a more advanced version of this structure for the turret cheek protection of the T-72B. Contrary to popular belief, the Russians use a NERA-based sandwich armor design like Western countries, although there are some important differences.

NERA aims to provide similar protection as explosive reactive armor (ERA) but does not contain explosives. Two metal plates sandwich the lining, such as aramid, which is heat resistant and strong. When hit by high-explosive anti-tank (HEAT) cap ammunition, some of the impact energy is dissipated into the lining layer, and the plates in the impact area swell and bend due to the high pressure created. The thickness of the armor increases and maximum effectiveness is ensured by preventing the projectile from make a clean hit due to the deformations.

A single NERA plate provides less protection compared to ERAs, but more





we realized the truth. The ammunition cessful m that hit the tank as a result of our shots a symbol would enter from where it hit and exit much so from the opposite side. There were to be at a incredible breaks in the armor and the conflicts is tanks became unrecognizable."

The defeat experienced here caused a great revolution in the turret protection of the T-90 tanks, which were inspired by the T-72B. In 2004, the T-90A was modernized. All of the T-90 tanks underwent this modernization, and the previous version was erased from history. With this modernization, a hexagonal turret structure emerged, and with this structure, these tanks advanced in turret protection. Similarly, the T-72B3 modernization also took place in the coming years.

Just like the T-34 tanks, T-72s are easy to manufacture, quite cheap compared to their counterparts, have good firepower, give a certain level of confidence in terms of protection, and as with the T-34-85, have progressed with successful modernizations. It has become a symbol of adaptation once again. So much so that the T-72 tanks continue to be at the forefront in the ongoing conflicts in different regions.

#### **T-72B3 IN USE SINCE 2012**

With the additional updates, a new fire guidance system was added to the tank that incorporated the aiming periscope, which included night vision. Thanks to this system, the tank

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T-72 tanks, which were already on the brink of being retired to the dusty pages of history, faced their biggest and most difficult test against Turkish SİHAs. In total, more than 70 T-72 tanks were destroyed by MAM-L in Syria, Libya and Karabakh. MS DEFENCE MAGAZINE

#### **HEAVY TRIAL IN IRAQ WAR**

period. It is easily replaced.

dem head ammunition.

protection is provided by placing multi-

ple plates, with the number depending

on the amount space for armor swell-

ing. It is more advantageous than ERAs

as it is not disposable and is more effec-

tive if used more than once against tan-

It has a lifespan of approximately five

years and should be replaced after this

The T-72 tanks would face their next serious test in the 2003 Iraqi military intervention. T-72 tanks suffered a heavy defeat in this process they had never encountered before. So much so that many British tankers who intervened said, "When we shot at an enemy tank, we could not understand whether we had hit the tank or not."

Others said: "At first, we used to fire more than one shot just to be sure, but when we got to the tanks we hit,





can detect and recognize targets up to 5 kilometers away, 24 hours a day.

The tank is also equipped with a digital ballistic calculation device with sensors that detect meteorological and topographic conditions. The device in question ensures that the shooting preparation process is carried out automatically and significantly increases the accuracy of the shot. The new firing guidance system guarantees a high probability of hitting targets up to 5 kilometers away with the missiles fired from either a fixed position or in motion. With the integration of the target tracking automation system, accuracy was improved while shooting at stationary or moving targets. The tank is also equipped with modern dynamic protection systems and digital communication tools.

To improve the agility of the tank with the increased weight, a turbo diesel engine that provides 30% more power is used in the T-72B3 tank compared to the previous model. The modernized T-72B3 was shown to be able to compete on equal terms with the world's best tanks.

#### LOSING ITS EDGE

Slowly heading toward the dusty pages of history, T-72 tanks came up against their hardest test yet against Turkish SİHAs. As a result, heavy-class ERAs such as the Kontakt5 and Relikt have been added to T-72 tanks to increase protection against HEAT-cap anti-tank munitions in B and B3 modernizations.

In fact, ERA has been installed in certain areas of the turret roof to protect against ammunition like the Javelin targeting the ceiling armor, the weakest area most likely to suffer fatal damage if targeted. Heavy-class Relict ERAs surround the turret, while Kontakt1 ERAs are placed in specific sections of the ceiling. Although ERAs do not provide absolute protection against tandem-headed ammunition, they provide some protection against this type of ammunition due to the expansion that occurs when hit.

#### TURKISH SİHAS AND MAM-L AMMUNITION

In total, more than 70 T-72 tanks were destroyed by MAM-L in Syria, Libya and Karabakh. When we look at the models of the T-72 tanks that are actively used in Syria, we see the M, A, AV, B and B3 models; the A, AV, B and B3 models were used by the invading Armenian



To improve the agility of the tank with the increased weight, a turbo diesel engine that provides 30% more power is used in the T-72B3 tank compared to the previous model.



forces in Karabakh. In Libya, T-72A and AV models serve Haftar's forces.

With a piercing capacity of more than 700 mm, the tandem-head MAM-L destroys T-72 tanks by hitting them at an angle, usually at the rear of the turret or toward the middle of the tank, that is, the area where the ammunition is lined up around the autoloader.

Shots made with the same angle from the opposite direction are not recommended due to the possibility of hitting the top of the gun shield, which would reduce the effectiveness of the MAM-L. Shooting to the side areas with a similar angle is not preferred because heavy class ERAs such as the Relikt or Kontakt-5 create a significant temporary armor effect and increase effective protection due to the angle.

Since it is not possible to target and hit tanks at angles close to 90 degrees from the altitudes at which SİHAs fly, the optimum solution has been found via the knowledge of the Turkish Armed Forces (TSK), which extends back more than 2,000 years. Successful products designed by Turkish engineers and Turkish companies, combined with the knowledge of the Turkish Armed Forces and skilled personnel, have seen great results.

Turkish companies have produced several very successful product lines. ROKETSAN developed the modern long-range air-to-surface Laser Guided Anti-Tank Missile (L-UMTAS), the lightweight Smart Micro Munition MAM-L was developed by Turkish Aerospace Industries, Inc. (TAI) as well as the unmanned aerial vehicle family ANKA, and Bayraktar TB2-type armed unmanned aerial vehicles were developed by Baykar Defense.

Shots made with the same angle from the opposite direction are not recommended due to the possibility of

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hitting the top of the gun shield, which would reduce the effectiveness of the MAM-L.

# Fighter Pilots Final Destination Jett Taineers

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Ahmet Yasir KAYA ★ Defense Researcher



et trainers are critical for training fighter pilots, who form the backbone of air forces. Today, many varfous projects are still ongoing in this field. As fifth-generation jets become widely added to military inventories, the development process for jet trainers continues. Countries preparing for new-generation aircraft are turning to jet trainers to take advantage of the advanced technology. In addition to technological developments, another factor affecting the demand for jet trainers is countries' efforts to arm themselves cost-effectively. Countries trying to create an air force but cannot allocate large budgets are turning to jet trainers. The main reason for this trend is that light attack missions can be performed with jet trainers. These

aircraft, which can be operated within lower budgets compared to



fighter jets, are becoming more and more preferable.

#### HÜRJET

HÜRJET, which made its first flight on April 25, 2023, is a jet training and light attack aircraft developed by Turkish

A erospace Industries (TAI). It is an aircraft developed to train fighter pilots to perform various tasks, such as light attacks and aerobatic maneuvers. With this feature, it is capable of fulfilling the tasks of many platforms currently used by the Turkish Air Force.

The Turkish Air Force uses T-38 Talon aircraft for jet training at the 121st Squadron of the 2nd Main Jet Base in İzmir's Çiğli. The T-38 Talon was developed by Northrop of the U.S. and is still used in the U.S. Air Force. These aircraft have also undergone a modernization process in the Turkish Air Force. This modernization, called the Bee Modernization, includes 55 aircraft. The military plans to modernize the first five aircraft at TAI facilities, and the remaining 50 aircraft at the 1st Air Supply Maintenance Center Command in Eskişehir. The first modernized aircraft was delivered in 2012. Within the scope of modernization, avionic improvements to respond to modern demands have been made on the aircraft. In addition, logistic support is expected to be established in the upcoming years.

Today, like many other air forces, the Turkish Air Force is preparing to use fifth-generation fighter jets. The air force, which has already started to operate fifth-generation warplanes, plans to renew its jet training fleets, after updating its destroyer fleets. When the T-38s developed with Arı Modernization were unable to effectively perform tasks, the need for new jet trainers such as HÜRJET emerged. The technological development and new operational concepts included in

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Today, like many other air forces, the Turkish Air Force is preparing to use fifth-generation fighter jets. It also needs modern jet trainers for training pilots who will use these planes.



the fifth-generation aircraft have led to new needs regarding the training of pilots. In addition, considering the capabilities of the Turkish Air Force in training jet pilots, developments in jet trainers will maintain an effective pace.

Single A and double B versions of NF-5 2000 Freedom Fighter aircraft of the 134th Squadron at the 3rd Main Jet Base in Konya are used by the Turkish Stars. HÜRJET, which can also be used as an acrobatic demonstration aircraft, can be evaluated as an alternative to the aging aircraft of the Turkish Stars.

F-16 aircraft, which make up the majority of the destroyer fleets of the Turkish Air Force, perform a wide variety of tasks. While studies and updates continue to increase the number and capabilities of the aircraft, steps can be taken to overcome current problems by easing the duty load of F-16s and using them more effectively. Apart from training activities, HÜRJET is planned to be

used in various air and ground missions. With a load capacity of approximately 2,700 kilograms, it can carry various ammunition for land targets.

Apart from land attacks, HÜRJET can also perform air patrols. With a maximum speed of 1.4 Mach and limits of +8G/-3G, the aim is to ensure a performance that can serve effectively in airto-air combat. The F404-GE-102 turbofan engine from General Electric's F404 engine family is used in this single-engine aircraft. The engine, which has a 17,700 lb thrust, has a wide range of platforms in which it is used. Just like HÜRJET, KAI's T-50 Golden Eagle from South Korea, the T-7A Red Hawk jet



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HÜRJET is an aircraft developed to train fighter pilots to perform various tasks, such as light attacks and maneuvering aerobatic aircraft. trainers from American Boeing and Sweden's Saab are powered by an F404 engine. Apart from these jet trainers, Swedish Saab's Gripen, Boeing's F/A-18C/D Hornet and India's HAL Tejas are also warplanes using this engine. Unlike the others, the F/A-18 Hornet uses dual engines.

When HÜRJET is evaluated in the light of these features, although it is a trainer aircraft, it can take on the role of destroyer aircraft to a certain extent. As TUSAŞ stated, air patrols and light ground attack capabilities, with or without weapons, are planned for HÜRJET. However, despite its potential, HURJET is not an aircraft capable of completely

> The T-50 Golden Eagle, developed by South Korea's Korean Aerospace Industries, is a jet trainer that has achieved wide export success with its models suitable for various missions.

replacing the F-16, but the duty load of the F-16s can be reduced and the life of the fuselage can be extended when select tasks are shifted to the new jet trainer. Overall, aircraft such as HÜRJET are very advantageous for countries whose air forces remain underdeveloped.

#### **T-38 TALON**

The T-38 Talon, which is actively used by the Turkish Air Force and the U.S. Air Force, has been produced in very high numbers so far. In addition, the German Air Force uses the T-38 Talon as a jet trainer. The planes of the German Air Force are stationed at air bases in the U.S. Pilots receive their training from the U.S. Air Force. The engines of the T-38 Talon, which has a twin-engine design, are J85 turbojet engines produced by General Electric. Each of these engines provides 3,300 lbs of thrust with an afterburner. Different versions of the J85 engine are also used in other aircraft models.

Except for the AT-38B model, the T-38 Talon is not a preferred platform for offensive missions. F-5 aircraft are designed for such missions. The AT-38B is a version that can integrate various weapon systems. There are several design differences between the F-5 and the T-38. For example, the leading edge of the part where the wing meets the fuselage is longer in the F-5, while this extension is absent in the T-38. In addition to a double-seat tandem cockpit used for training purposes, F-5 aircraft also have a single-seat version with a cockpit. A similar modernization to the Turkish Air Force's T-38s by TAI was carried out in the U.S. under the name T-38C. Various avionic and structural improvements were made with this modernization.

#### UAE'S HAWK AND T-45 GOSHAWK

Developed by British BAE Systems, the Hawk is an aircraft used for training and light attack purposes. Currently, it is used by many air forces. The T-45 Goshawk is a model developed to exceed the BAE Hawk. However, the T-45 Goshawk is capable of land-



ing and taking off from aircraft carriers. The United States Navy uses the T-45 Goshawk as a carrier-capable jet trainer. In the Navy's selection process, BAE Systems and the U.S. McDonnell Douglas group's project based on the BAE Hawk, and the French Dassault Aviation, U.S. Lockheed Martin and German Dornier group's Alpha Jetbased project were considered. In the end, the T-45 Goshawk was preferred. Later, many changes were made to the BAE Hawk, which could not land and take off from aircraft carriers, and these capabilities were gained. Both models use a British Rolls Royce production Turbomeca F405-RR-401 engine.

The T-45 Goshawk has a limited portfolio of training munitions due to its use for training purposes, while the BAE Hawk is capable of carrying a variety of munitions. This payload consists of short-range air-to-air missiles such as the AIM-9 Sidewinder, a 30 mm gun pod and guided bombs. In the fully loaded configuration, this capacity reaches approximately 3 tons, depending on the model of the butler.

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#### **T-7A RED HAWK**

In the project carried out jointly by Boeing and Swedish Saab to replace T-38 Talon aircraft in the jet training fleets in line with the plans of the United States Air Force, the T-7A Red Hawk jet trainer is in development. One aspect that distinguishes it from the double-seat, single-engine aircraft is the tail design with the double vertical stabilizer. The aircraft is expected to be in service with the U.S. Air Force by 2024. A total of 350 aircraft are planned to be delivered to the Air Force.

#### **T-50 GOLDEN EAGLE**

The T-50 Golden Eagle, developed by South Korea's Korean Aerospace Industries, is a jet trainer that has achieved wide export success with its models suitable for various missions. Poland, whose defense expenditures increased after the war between Ukraine and Russia, which started in 2022, received 48 FA-50 training-attack jets, as well as a high number of tanks and self-propelled howitzers, in the purchases agreed with South Korea. Finally, Malaysia purchased 18 units of the same type. The jet has so far achieved export success in Indonesia, Iraq, the Philippines, Thailand, Poland and Malaysia.

During the development process of the aircraft, a partnership was established with Lockheed Martin. In this context, Lockheed Martin's AN/APG-67(V)4 radar was also integrated. As with many similar aircraft, General Electric's F404 engine family was preferred. Besides the F404-GE-102 engine, a Full Authority Digital Engine Control (FADEC) has been integrated. This system provides important conveniences for the management of the engine and the monitoring of its main-

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tenance status. There are also four models available, namely T-50, FA-50, TA-50 and T-50B. Of these models, the T-50 is classified as a jet trainer, the T-50B as an aerobatic aircraft, the TA-50 as a pioneer jet trainer and the FA-50 as a trainer and attack aircraft.

Many common munitions are integrated into the aircraft, including a 20 mm cannon. In fighter jets, 20 mm automatic cannons are generally six-barreled. However, a three-barreled 20 mm gun was preferred. The aircraft, which can use general-purpose bombs, can also drop smart bombs with guidance kits. It can carry a total of six 500 lb Mk-82

> Greece's Hellenic Air Force recently received the M-346, which is also used in the Italian, Israeli, Polish and Singaporean air forces.

general-purpose grenades in triplicate at weapon stations on each wing. It can carry AGM-65 Maverick missiles as guided air-to-ground munitions. It also uses the AIM-9 Sidewinder as a short-range air-to-air missile. In addition, the ammunition used can be diversified in line with the requirements of the buyer country.

#### M-346 MASTER

While the Russian Yakovlev firm and the Italian Alenia Aermacchi were carrying out the Yak/AEM-130 project, the companies parted ways after 2000. Later, while Yakovlev continued the Yak-130 project, Alenia Aermacchi developed the M-346 Master. This aircraft, which has been used in the Italian, Israeli, Polish and Singaporean air forces, was recently received by Greece's Hellenic Air Force.

The twin-engine aircraft uses F124-GA-200 turbofan engines of the U.S. company Honeywell. Each of these engines provides up to 6,280 lbs of thrust. In addition to various air-to-air and air-to-ground ammunition capabilities, it has equipment for different missions, such as a targeting pod. Three different scenarios have been defined by the manufacturer, Leonardo, depending on the weapon configurations.

The M-346 Master can perform escort duty in a 150 nm (approximately 280 kilometers) operating radius with two short-range air-to-air missiles and machine gun pod configurations. The radius of action is reduced when an intercept condition is included in this scenario. Again, in the configuration with two short-range air-to-air missiles and an observation pod, it is predicted that a range of 300 nm (approximately 550 kilometers) can be observed from an altitude of 20.000 feet for 15 minutes. Again, in the configuration that includes air-to-air missiles, a range of 120 nm (approximately 220 kilometers) is foreseen in an attack scenario for land targets with four 500 lb laserguided bombs and targeting pods.

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## MODERN AMPHIBIOUS ATTACK SHIPS

Ahmet YILMAZ \* Defense Researcher

hen evaluating the power projection capabilities of armies, the role of amphibious landing craft should not be underestimated. This group of vessels is a rising trend in terms of today's military inventories as an important naval element for responding to any crisis that arises in war or peace. In addition to being a naval element, these platforms offer a wide range of use for other military branches, as well.

The trend favoring amphibious landing craft is more easily understood when the cost of producing an aircraft carrier is taken into consideration. However, it would be wrong to state that amphibious aircraft carriers are an absolute alternative to aircraft carriers. The tasks undertaken by the aircraft carrier task group, composed of the aircraft carrier and other naval elements, are much broader and address a different field.

Aircraft carriers operate as an airbase that can be transported at sea. Therefore, in addition to providing a runway for fighter planes to take off and land on its deck, aircraft carriers also require the air defense capabilities of task group ships and airborne early warning and control aircraft. In contrast, amphibious landing craft are platforms designed for the transport and landing of a certain military unit and their platforms.

Although the platforms to be carried by amphibious ships can be similar, there are some differences. Today, the idea that these ships are a good platform for the use of unmanned assets is increasingly common. There are various plans and applications for both rotary-wing and fixed-wing unmanned aerial vehicles for both ship types. As a smaller vessel, amphibious landing craft have a single runway, while aircraft carriers have two, for landing and take off. Though both types of ships could be designed with a ramp, the runways used for landing on aircraft carriers are flat. This is due to the risk of landing on aircraft carriers. Pilots often have to abandon the landing attempt, accelerate and take off again. For an aircraft accelerating after an aborted landing, the ramp at the end of the runway poses a great risk.

Helicopters are preferred in amphibious aircraft carriers rather than the use of fixed-wing and conventional take-off aircraft. The tasks of providing both logistics and close air support for landing can be achieved by helicopters that can be carried on the fuselage.

These ships play a major role in times of war and after natural disasters. Amphibious assault ships can undertake many tasks such as transporting people to safe areas by helicopter, treating the wounded in the on-board hospital and transporting aid. They serve as an important platform to access areas where roads and ports have been destroyed.

Although the platforms to be carried by amphibious ships can be similar, there are some differences.

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#### WASP AND AMERICA CLASS

The U.S. Navy is actively using the Wasp and America-class amphibious assault ships. The Wasp class is a platform based on the Tarawa-class amphibious assault ship. The Tarawa class is not currently on active duty. Between 1971 and 1980, five ships in this class were delivered to the Navy. Although it was planned to produce four more Tarawaclass Landing Helicopter Assault (LHAs) ships after 1980, Wasp-class Landing Helicopter Dock (LHDs) ships were chosen instead. After the first Wasp-class LHDs were put into service in 1989, a total of eight were added to the inventory. Seven of these eight ships are actively in use, and one is out of service.

As of 2014, Tarawa-class ships began to be retired with the commissioning of the first America-class LHA. After the delivery of the first America-class ship, 11 more ships are planned to be built. All Tarawa-class ships were withdrawn from service in 2015. To date, two America-class ships have been delivered, and the third ship is under construction.

The Navy's Wasp-class LHDs were manufactured by the U.S. defense industry company Northrop Grumman Ship Systems. The 253-meter-long ship allows multi-role use, including transporting Marine Expeditionary Unit (MEU) troops the U.S. Navy needs to quickly dispatch to crisis areas. The Marine unit consists of approximately 2,000 soldiers and the LHDs include the logistics and fire support means of these units. Therefore, Wasp-class LHDs also carry MEU's helicopters, landing craft and amphibious vehicles.

The helicopters it can carry are a mix of attack and transport models. It can carry various numbers of helicopters in different configurations, including CH-46 Sea Knights, CH-53E Sea



Stallions, UH-1N Hueys, MV-22 Osprey transporters and the AH-1W Super Cobra, which has attack capabilities. The U.S. Navy is still an active user of the H-1 series helicopters. The Navy uses both general and assault configurations, and both helicopters are in the helicopter fleet of Wasp-class LHDs. In addition, the tandem rotor CH-46 helicopter and the tiltrotor MV-22 helicopter are among the private aircraft in the fleet.

Apart from helicopters, it has the capability of supporting fighter jets, namely the AV-8 Harrier and the F-35B Lightning II. It can carry six or eight Harriers. As landing platforms, two vehicles are used with these ships, a choice of three LCAC Landing Craft Air Cushion (LCAC) hovercraft or two Landing Craft Utility (LCU) landing craft. In addition, transporting various armored vehicles such as five M1 Abrams main battle tanks, eight M198 howitzers, 68 Humvees and fire support vehicles is also included in the Wasp class's capabilities. One M1A1 main battle tank can be transported with LCAC hovercrafts.

The Wasp class, like many other amphibious assault ships, is equipped with weapons for the platform's self-defense. In this context, its defense weapons consist of two Rolling Airframe



Amphibious landing ships present an operational advantage across the board thanks to their wide range of use as an effective naval element.



Missile (RAM) launchers, two Sea Sparrow launchers, two 20 mm Phalanx Close-In Weapon Systems (CIWS), and seven double-barreled and .50 caliber machine gun turrets. The RAM launcher contains RIM-116 air defense missiles. This weapon system is used to intercept incoming anti-ship missiles. Launched from the Sea Sparrow launcher, the RIM-7 missile is the AIM-7 air-to-air missile adapted for naval platforms.

Of the eight Wasp-class LHDs built, the USS Bonhomme Richard (LHD-6) was withdrawn from service in 2020 after a fire while in port for maintenance. The high costs required to put the ship back into service after the fire led to its decommissioning.

Replacing the Tarawa-class LHAs, the America-class LHA(R) is designed to exhibit an improved aerial platform operational performance compared to the Wasp class. While the MV-22 and F-35B platforms were integrated later on Wasp-class ships, these two platforms are expected to be the main air capability of America-class ships. The American class will also offer two configurations, Flight 0 and Flight 1. In the Flight 0 version, most of the space on board is designed to be used for the maintenance of transported aircraft and the storage of jet fuel. In the Flight 1 version, while the capabilities of Flight 0 are preserved, it also includes a well dock for increased amphibious attack capabilities. This dock allows landing craft to be used with America-class ships.

So far, the USS America (LHA 6) and USS Tripoli (LHA 7) have been built and delivered. Both these ships are the Flight 0 configuration. The USS Bougainville (LHA 8), which will be the first ship in the Flight 1 configuration, is still under construction. MH-60S Seahawk helicopter squadrons can also be supported on the Americaclass ships, which are similar to the Wasp class in terms of self-defense equipment. The Flight 0 configuration will not use landing craft, while the Flight 1 configuration will have LCAC and LCU capabilities.

#### **MISTRAL CLASS**

France's Mistral-class amphibious assault ship has entered production. Three of these ships are used by the French Navy, while the other two ships



On Mistral-class ships, Egypt can use the U.S. AH-64 Apache and Russia's Ka-52 Alligator helicopters.





are used by the Egyptian Navy. The ships used by the Egyptian Navy were produced for Russia before they were delivered. Russia has placed a total of four orders, the first of these ships being definite and three of them as options. The initial production schedule included the first two ships being produced by France and another two ships built in Russia with joint production. However, after the crisis between Ukraine and Russia in 2014, this purchase was not realized. The two ships to be built in France were sold to Egypt. The ship, which can be defined as multipurpose, can be used for various missions thanks to the platforms it uses. Command and control of the operations carried out, power transmission, transportation and providing humanitarian aid for disaster-war situations are all included in the capabilities of the vessel. In addition, it has a bed capacity of 69 that can be increased according to the need. It also has two operating theaters. With this medical support, it can be used to help regions that have been deprived of health services as a result of natural disasters such as earthquakes or the collapse of hospitals due to a conflict. Its onboard transport helicopters allow access to offer aid and support to settlements that are far from the coast or whose ports have become unusable.

On Mistral-class ships, Egypt can use the U.S.' AH-64 Apache and Russia's Ka-52 Alligator helicopters – an option first introduced by Russia as a specification for the order that later fell through and was instead purchased by Eygpt.

It has a platform and hangar capacity for 16 helicopters. The number of helicopters used by France on Mistral-class ships varies according to the configurations. Thirteen tanks or 60 armored vehicles can be transported in the 2,650-square-meter hangar. It can carry



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The tasks undertaken by the aircraft carrier task group, composed of aircraft carriers and other naval elements, are much broader, addressing a different field.





between 400 and 900 soldiers, along with a crew of 177 people. It also has the capacity to host four landing boats.

The ship's ability to defend itself includes two remote-controlled 20 mm guns and four 12.7 mm machine guns. Although these capabilities have become standard in general, studies for the integration of higher caliber guns and advanced guided weapons continue. The SIMBAD weapon system is used for short-range air defense. This system carries two Mistral short-range air defense missiles.

> Along with the Spanish Navy, the Turkish and Australian navies also use ships developed based on on Juan Carlos I's specifications.

#### JUAN CARLOS I, TCG ANADOLU, CANBERRA

In 2002, the Spanish Navy published a document declaring the need for a multipurpose platform capable of transferring forces and operating aircraft at the same time. In line with the document, the details of which were determined as of March 2004, the Spanish Navy gave the order to the Spanish state-owned company Navantia to start the construction of the ship. The ship was delivered to the Spanish Navy in 2010.

The first one entered service in the Spanish Navy as Juan Carlos I (L-61). Then, with the commissioning of two ships in the Royal Australian Navy, a total of three platforms became active. Finally, with the active use of TCG Anadolu (L-400) by the Turkish Navy this year, the number of platforms in active use has reached four. It should be noted that all platforms have variable capabilities that are shaped in line with the specific needs of the countries. Navantia also built the hull and deck of both of Australia's ships. However, the hulls, which were subsequently transferred to Australia, were equipped by BAE Systems Australia. Türkiye's experience with the construction of these ships is different from that of Australia. Türkiye carried out the production of the ship with a process that includes license and technology transfer. Unlike in Australia, the Turkish ship was not built in a shipyard in Spain. The construction process for the TCG Anadolu was carried out at Sedef Shipyard in Istanbul.

While the U.S. America and Waspclass ships with similar characteristics are about 260 meters long, France's Mistral-class ships measure around 200 meters. TCG Anadolu, on the other hand, is approximately 230 meters long, falling between the ships in these two classes.

While Spain used AV-8B Harrier II vertical take-off aircraft on the L-61 platform, Türkiye was on the agenda to use F-35B aircraft on the L-400. However, at this point, the use of various manned/ unmanned systems as fixed-wing platforms on the ship is on the agenda. Hürjet, Bayraktar, Kizilelma and TB-3 are all platforms associated with TCG Anadolu. Compared to the TB-2, the TB-3 is a larger and more payload-bearing platform. It is also planned to have folding wings due to the limited space on the ship's deck.

Tests of AH-1W Super Cobra and S-70B SeaHawk helicopters continue on TCG

In 2002, the Spanish Navy published a document declaring the need for a multipurpose platform capable of simultaneously transferring forces and operating aircraft. The multipurpose amphibious assault ship-aircraft carrier Juan Carlos I was soon added to the inventory in 2010. Anadolu regarding the ability to use helicopters on board. The NH90, CH-47 Chinook, Eurocopter Tiger and SH-3 SeaKing are other helicopters that can be used. Although the CH-47 is a helicopter owned by the Turkish Armed Forces, a test for its use in TCG Anadolu has not yet been conducted.

The 94-vehicle configuration of TCG Anadolu is expected to include 13 tanks, 27 Armored Amphibious Assault Vehicles (ZAHA), six Armored Personnel Carriers (APCs) and various other vehicles. It has been announced that the tests have started with the Altay tank. Spain's main battle tank landing capability on the L-61 platform is based on Leopard 2E tanks. For these land vehicles, the ship's landing well has a capacity of four carrier platforms. A personnel carrying capacity of up to 1,500 is among the capabilities of the ship. There is also a hospital on board.

The Spanish Navy specifies four 12.7 mm remotely controllable turrets in the context of the L-61's defensive capabilities. However, it is stated that there is

an area on the ship where additional defensive weapons can be placed if needed. CIWS and ESSM (Evolved Sea Sparrow Missile) weapon systems can be integrated if needed. ESSM is an enhanced version of RIM-7. Five of the 25 mm stabilized gun systems (ASELSAN STOP) developed by ASELSAN are expected to be used on TCG Anadolu. Defensive capabilities specified by the Royal Australian Navy on Canberra Class ships include four 20 mm and six 12.7 mm guns. In addition, the Nixie torpedo decoy system is also installed on the ships. This system launches decoys to deflect an approaching torpedo by deceiving the guidance system of the approaching projectile. The Royal Australian Navy has also announced that space is reserved on the ship for the Nulka missile decoy system. Nulka decoy missiles are launched as defense targets for enemy anti-ship missiles targeting the vessel.

#### **DOKDO CLASS**

Two examples of the approximately 200-meter-long ship have been produced. The first, ROKS Dokdo (LPH-





and V-22 Ospreys are other helicopters that can be used on the vessel. Likewise, F-35B aircraft can also be used with the Izumo class. Platforms such as armored vehicles and tanks are not carried on ships in these two classes.

#### **TYPE 075**

Three ships, which are approximately 240 meters long, of this class have been produced. In 2021, the first ship, the Hainan, was delivered to China's People's Liberation Army Navy as its largest amphibious warship. In April and October of 2022, the second and third ships, Guangxi and Anhui, were delivered. Type 730 constitutes the armament of 30 mm CIWS and HQ-10 short-range surface-to-air missile carriers. The HQ-10 is used as a substitute for the RAM weapon system.

The platform, which has a well dock, can be used to land mechanized infantry units. Depending on the configuration, two or three Type 726 LCAC landing platforms can be transported on board.

6111), entered service in 2007 and the second, ROKS Marado (LPD-6112), entered service in 2021. Both ships are still in active use.

LPD-6111 has the capacity to carry 720 personnel, 300 of which are crew members. It can carry 10 main battle tanks, seven Assault Amphibious Vehicles (AAV) and three field guns. If only helicopters are to be transported in the hangar, 10 helicopters can be deployed. Although the UH-1H and UH-60P are actively used helicopters, one V-22 Osprey can be carried on the fuselage. On the second ship, the LPD-6112, the number of V-22 Ospreys has been increased to two. The LPD-6111's defensive weapons consist of RAM and

> The Hyuga class is a platform that can be used in antisubmarine warfare missions. SH-60K helicopters suitable for this mission are deployed on the deck of the ship.

Goalkeeper CIWS. In LPD-6112, these capabilities consist of two Phalanx CIWS and K-SAAM. Surface-to-Air Anti-Missiles (K-SAAM), an air defense missile developed by South Korea, was designed to replace the RAM system.

#### **HYUGA AND IZUMO CLASS**

The Japan Maritime Self-Defense Force has two Hyuga and two Izumo-class ships. The first of the Hyuga-class ships, Hyuga (DDH-181), entered service in 2009 and the second, Ise (DDH-182), in 2011. The length of the ships is about 200 meters. The first of the Izumo-class ships, Izumo (DDH-183), was put into service in 2015, and the second, Kaga (DDH-184), was put into service in 2017. The length of the Izumo-class ships is approximately 250 meters.

The Hyuga class is a platform that can be used in anti-submarine warfare missions. SH-60K helicopters suitable for this mission are deployed on the deck of the ship. In addition, AH-64 Apache attack helicopters, AgustaWestland AW101s, Sikorsky CH-53 Sea Stallions



E-2D ADVANCED HAWKEYE

# SKY A VIACS SPOTTERS A VIACS PLANES

Ahmet YILMAZ \* Defense Researcher

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Radar systems play an important role in warding off threats during peacetime and war. However, there is a limit to the range of fixed radar systems. The solution was to design aircraft with effective radar systems. These aircraft, called the airborne early warning and control systems, or AWACS, undertake the task of scanning the airspace of countries. AWACS were developed especially during the Cold War and still maintain their importance today.

### **UNITED STATES**

### Northrop Grumman E-2 Hawkeye

The E-2, an AWACS aircraft developed particularly for the U.S. Navy, first entered service in 1964 for use on naval aircraft carriers. The first E-2 aircraft to be added to inventories was the E-2A. During the initial production of 59 aircraft, overheating problems arose in its avionics. Soon after, the E-2B model emerged featuring changes in various electronic elements, and as a result, 49 of the first 59 aircraft produced included this electronic modernization.

After the heating issues in the avionics were resolved, the first comprehensive updates, including changes to the radar and computers, were made to the E-2C model, initially called Group 0. The aircraft served the U.S. Navy in the '80s and '90s. E-2Cs carried out missions by communicating via the Link-4A data link with the F-14 Tomcat aircraft, which were also developed by Northrop Grumman and were on duty on the American Navy's aircraft carriers during these years.

The first aircraft in the E-2C Group 0 model used the AN/APS-120 radar, which was also used in the first B version of the E-2. The AN/APS-120 has an antenna that rotates six times per



minute and emits waves at a frequency between 298 and 303.5 Hz. This model is a long-range Doppler radar operating in the ultra-high frequency (UHF) band between 300 MHz and 3 GHz. Doppler radars emit radar signals at the speed of light. These emitted signals are detected again by reflecting from the target and the distance is calculated according to the elapsed time. The Doppler effect is also used to measure the speed of the target. Likewise, pulse Doppler radars also emit these waves at regular intervals and measure the speed of the target according to the change in the radar wave due to its speed.

Later aircraft in Group 0 used the AN/ APS-125 radar, with the E-2 Hawkeye receiving the first radar modernization. The AN/APS-125 radar can detect and track land targets autonomously, a feature not included in the AN/APS-120. In addition, the lifespan of the AN/APS-125 radar was further extended. Like the AN/APS-120, it has an antenna placed on the aircraft in a rotating radome with a diameter of 7.93 meters (26 feet). The next version of the E-2C model, which included engine and radar updates, was called Group I.

With the AN/APS-138, the range of the radar was extended to 550 kilometers (340 miles). The AN/APS-139 radar, an improved version of the AN/APS-138, was also integrated into the aircraft produced with Group I. With Group I, the transition to the AN/APS-139 radar was made. AN/APS-145 radar integration was carried out with Group II, which includes the last aircraft of the E-2C. The AN/APS-145 radar, which has

The E-2D Advanced Hawkeye, the latest version of the E-2, stands out with updates in its radar and cockpit.



a 40% wider range than the AN/APS-139, can track 20,000 targets simultaneously and can observe a volume of 6 million cubic miles.

Another important change that came with the E-2C Group I was in the aircraft's engine. The T56-A-425 turboprop engine produced by Allison Engine Company used in the previous models was replaced with the T56-A-427 model of the same engine. In a later variant called E-2C+, the propeller was changed. The eight-bladed NP2000 propeller produced by Collins Aerospace, owned by the U.S. defense and aerospace company Raytheon, was integrated into the aircraft. Just as it is integrated into the two engines of the E-2, this propeller can also be used on the C-130 Hercules transport aircraft, which has four turboprop engines. The main feature of NP2000 is that its propellers can be controlled electronically instead of via mechanical parts. The wings, each made of composite material, can be disassembled and installed independently of each other. Thanks to these features, the aircraft's performance increases and its cost decreases. It works 20 dB quieter and creates less vibration than its counterparts. It provides 20% more thrust, and thus the aircraft requires 300 meters less distance to take off when heavily loaded. In addition, maintenance time and costs are reduced by half.

The E-2D Advanced Hawkeye, the latest version of the E-2, stands out with the changes in its radar and cockpit. Although other models use a Doppler radar, the E-2D uses both an electronic radar system, such as the active electronically scanned array (AESA) radar and a mechanically rotating radar system, as in the previous models. Thanks to this radar, called AN/APY-9, the E-2D provides an advantage in detecting fifth-generation aircraft. In addition, the E-2D provides guidance for AIM-120 AMRAAM and SM-6 radar-guided missiles fired by friendly elements.

The E-2D Advanced Hawkeye also has mortar refueling capability. The E-2D, which features a glass cockpit, thus becomes a modern platform. Additionally, changes were made to the radio systems, mission computer, satellite communication systems, flight control system and engine. The TP56-A427A version of the TP56-A-427 turboprop engine, integrated into aircraft with E-2C Group I, is used in E-2D Advanced Hawkeye aircraft.

### **Boeing E-3 Sentry**

Unlike the E-2, the Boeing E-3 Sentry is an AWACS aircraft designed for air forces, not navies. It is a version of Boeing 707, Boeing's four-engine passenger aircraft, equipped with various electronic systems. It is actively used by the U.S. Air Force, NATO, the Chilean

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The E-3A, the first massproduced version of the E-3 Sentry, has the AN/ APY-1 radar. It uses four Pratt & Whitney TF33 turbofans as engines.



Air Force, the French Air Force and the Saudi Arabian Air Force. The Chilean Air Force uses three retired E-3D aircraft from the U.K. Royal Air Force.

The E-3A, the first mass-produced version of the E-3 Sentry, has the AN/APY-1 radar. It uses four Pratt & Whitney TF33 turbofans as engines. Saudi Arabia, on the other hand, preferred a different engine in its E-3A model aircraft. The CFM56 turbofan engine of CFM International, a joint subsidiary of the American GE Aerospace and the French Safran Aircraft Engines. is used in the E-3A aircraft of the Saudi Arabian Air Force. The U.S. Air Force modernized its 24 E-3A aircraft via the Block 30/35 modification program, renaming the E-3As that underwent Block 30 modernization as E-3Bs. Within the scope of this modernization program, a GPS navigation system was integrated into the aircraft. The aircraft was included in the Joint Tactical Distribution System (JTIDS) and Link 16 data link.

In the Block 35 modernization, the AN/ APY-2 radar was integrated into the aircraft, labeled E-3C. England also purchased aircraft with this radar but preferred CFM56 as the engine. England's planes are called E-3D due to the difference in the engine. The CFM56 engine aircraft of the same standard as those purchased by France from England were named E-3F.



The Block 40/45 modernization includes various software and avionics updates. The aircraft subjected to this modernization are called E-3G. Additionally, glass cockpit integration was included in the E-3G aircraft.

### Boeing E-767

This version was created by integrating the E-3's hardware into the Boeing 767-200ER passenger aircraft. Four E-767s were produced for the Japan Air Self-Defense Forces. The Boeing 707 aircraft, on which the E-3 is based, is much smaller than the 767. It is powered by two General Electric CF6-80C2 turbofan engines.

It uses the AN/APY-2 radar used in advanced E-3s. Just like the E-3, a 9.14meter diameter radar antenna is placed on the fuselage as a rotating radome.

### **Boeing E-7**

The E-7 is based on the 737-700 model of Boeing 737, the most used passenger aircraft in civil aviation.

The first of the modifications of the four E-7T Peace Eagle aircraft owned by the Turkish Air Force from passenger aircraft to AWACS aircraft was carried out in the U.S., and the other three

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The E-7 is in active service with the Royal Australian Air Force, the Republic of Korea Air Force and the Turkish Air Force.

ÜRK HAVA KUVVETLERİ

**Turkish Air Force E-7T** 

were carried out at Turkish Aerospace Industries (TAI) facilities in Ankara. TUSAŞ took part in the modification processes of the E-7T, ASELSAN took part in the radio and electronic support systems, and HAVELSAN took part in the mission computer software.

E-7's radar, unlike the E-2 and E-3, is not in a rotating radome. The radar, which is fixed on top of the aircraft and placed along the length of the aircraft, remains stationary. The radar developed by Northrop Grumman is called the multi-role electronically scanned array (MESA). The radar provides 360-degree observation capabilities. Although various information has been shared about the range of the radar, Boeing states that the radar can detect a target traveling at an altitude of 10,000 feet from a range of 610-plus kilometers, and a target traveling at an altitude of 500 feet from a range of 390 kilometers.

### ISRAEL

### IAI EL/M-2075 Phalcon

Developed by Israel Aerospace Industries (IAI), Israel's defense and aerospace company, the EL/M-2075 Phalcon is based on the Boeing 707 passenger aircraft. There is a special radome design in the nose of the aircraft. The AESA radar inside the radome remains stationary. These electronic systems integrated into Boeing 707 can also be integrated into Boeing 767 and Boeing 747. The Israeli Air Force actively uses two of these aircraft.

### IAI EL/W-2085

The IAI has introduced the EL/W-2085 conformal airborne early warning and control (CAEW) aircraft as a less costly AWACS than the EL/M-2075 Phalcon. The EL/W-2085 is in active service with the air forces of Israel, Singapore and Italy. It was developed based on the U.S. Gulfstream's G550 business jet, which is a smaller aircraft compared to the



Phalcon. Radar antennas on the aircraft are located on the right, left, nose and tail of the fuselage. A design that would not adversely affect the aerodynamic structure of the aircraft as much as possible was preferred for the radome of the radar antennas. The radomes located on the right and left of the fuselage are for radar antennas operating in the L-band. The radomes in the nose and tail contain the antennas of the radar operating in the S-band.

### **SWEDEN**

### Saab 2000 Erieye

The PS-890 Erieye AESA radar, developed by the Swedish company Ericsson Microwave Systems in the second half of the '80s, was integrated into various aircraft by Saab, a Swedish company, and AWACS aircraft were developed. The Saab 2000 AWACS aircraft was developed by integrating the Erieye radar into the Saab 340, a twin-turboprop engine passenger aircraft.

### Saab GlobalEye

The Saab GlobalEye AWACS aircraft was created by integrating the Erieye extended range (ER) radar, the extended range version of the Erieye radar, into Canadian Bombardier's Global 6000 and Global 6500 business jets. The aircraft, which can stay in the air for 11 hours, can detect targets 458 kilometers away from an altitude of 35,000 feet.

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The Saab GlobalEye AWACS aircraft was created by integrating the Erieye extended range (ER) radar, the extended range version of the Erieye radar, into Canadian Bombardier's Global 6000 and Global 6500 business jets.



### **UNITED KINGDOM**

### Nimrod AEW3

The British Aerospace Nimrod AEW3 is an aircraft developed for the British Royal Air Force and designed specifically for long-range early warning and control purposes. This particular aircraft is equipped with advanced radar systems to detect maritime threats and monitor airspace. The Nimrod AEW3's radar dome offers a wide range of surveillance and target-tracking capabilities and is ideal for detecting air and sea threats at long ranges. Nimrod's avionics are also manufactured by Marconi Avionics.

The design of Nimrod AEW3 also includes the AN/APS-125 radar. A total of 11 units of the AEW3, which made its first flight in 1980, were produced, three of which were prototypes. Used only by the Royal Air Force, the AEW3 operates with up to 12 crew members. It has a length of 41.97 meters, a height of 10.67 meters and a wingspan of 35.08 meters. Using four Rolls-Royce RB 168-200 turbofan engines producing 12,140 lbs thrust as its power source, the AEW3 can reach a maximum speed of 563 kph and an altitude of 36,000 feet. Featuring GEC Marconi Argus-2000 avionics systems, the AEW3 includes Thorn EMI Skymaster F band pulse doppler radar, a Loral ARI-18240/1 electronic support system, a Cossor Jubilee Guardsman Friend-Foe System and a Ferranti FIN 1012 internal navigation system.

### RUSSIA

### **Beriyev A-50**

The Beriyev A-50 is an important air early warning and control aircraft developed during the USSR period and is still used. The A-50 is a system based on the II-76 transport aircraft and is designed for guidance of longrange air defense systems and air traffic control. The A-50 can detect enemy air and missile threats and enable air defense systems to respond quickly and effectively. Designed to replace the Tupolev Tu-126, the A-50 made its first flight in 1978 and was produced in nearly 40 units until 1992. The A-50 entered the USSR inventory in 1985. The A-50M has an aerial refueling system and electronic warfare systems. The A-50U model is a model of the A-50M model with modern avionics systems. The A-50EI model is the foreign trade model of the A-50 and has the EL/W 2090 radar system of Israeli origin. The aircraft, which was

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According to data, the A-50 can detect air targets at a distance of up to 650 kilometers and detect targets up to 300 kilometers away with its Liana surveillance radar.



first used by the USSR, was also used by Russia after the dissolution of the USSR. India has ordered two A-50EIs. The A-50 operates with 15 crew members, has a length of 49.59 meters, a wingspan of 50.5 meters and a height of 14.76 meters. Powered by four Soloviev D-30KP turbofan engines producing 26,460 lbs of thrust, the A-50EI variant of the A-50 uses the Aviadvigatel PS-90 turbofan engine producing 38,400 lbs of thrust. The A-50 can reach a maximum speed of 900 kph and has a flight range of 7,500 kilometers. Its Liana surveillance radar can detect air targets up to 650 kilometers away and land targets

The KJ-2000, which is only in the Chinese inventory, has the same structural parts and physical properties as the Il-76.

up to 300 kilometers. The Vega-M radar produced by NPO Vega and MNIIP can detect 150 targets up to 230 kilometers.

### **CHINA**

### KJ-2000

The KJ-2000 is an AEW&C aircraft designed based on the Ilyushin Il-76 transport aircraft, like the Beriyev A-50. After China launched a program to

develop an indigenous AWACS aircraft in 2000, the KJ-2000 made its first flight in 2003. It features phased array radars in the radome of the aircraft. Although there is no exact information about the total number of platforms produced and in service, it is estimated that there are a total of eight in the Chinese inventory. While the radome rotates in U.S.produced AWACS, it does not rotate in



the KJ-2000. Three phased array radars are placed in a triangular configuration inside the circular outer surface of the radome for 360-degree coverage. This antenna system operates in the 1200-1400 Mhz frequency range. The maximum range of this system is 470 kilometers. The KJ-2000, which is only in the Chinese inventory, has the same structural parts and physical properties as the Il-76. At the same time, China is also developing a variant with a new generation radar called KJ-3000. In addition, due to the limited Il-76 supply from Russia, China is looking for ways to use the Y-20 in the KJ-2000s.

### KJ-200

The KJ-200 AEW&C aircraft is designed based on the Y-8 medium-class transport aircraft, which can be considered a replacement for the KJ-2000 due to the problems that may be encountered in the supply of aircraft by China. The KJ-200 has an AESA radar integrated into a system similar to the "Erieve" system designed by Saab. The cockpits of 80% of the KJ-200s produced by Shaanxi, which is also the manufacturer of the Y-8, have been modified to be a glass cockpit, unlike normal Y-8s. Eleven KI-200 aircraft, whose engines are Pratt & Whitney Canada PW150B with a power generation capacity of approximately 4,000 kW and whose avionics are produced by Honeywell, have been produced, and these aircraft are in the Chinese People's Liberation Army Air Force and the Chinese People's Liberation Army Navy. The range of the aircraft, which reaches a maximum speed of 660 kph, is 5,600 kilometers.

### KJ-500

KJ-500 is an AEW&C aircraft produced by Shaanxi and based on the Y-9 medium-class transport aircraft in its design. More than 34 KJ-500s are used within the Chinese People's Liberation Army, 20 of which are in the air force and the remaining aircraft are in the navy. The KJ-500A variant is also capable of aerial refueling. The KJ-500, developed in the 2000s, includes a similar triple radome system used in the KJ-2000 for 360-degree scanning. Using four 5,100 kW Zhuzhou WoJiang-6C turboprop engines, the KJ-500 has a length of 36 meters, a wingspan of 40 meters and a height of 11.5 meters. The aircraft reaches a maximum speed of 550 kph and has a range of 5,700 kilometers.

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More than 34 KJ-500s are used within the Chinese People's Liberation Army, 20 of which are in the air force and the remaining aircraft are in the navy.



## ON WAR Ahmet YILMAZ ★ Defense Researcher CAUTION **3A**3 CAUTION 3A5

owadays, naval warfare is becoming increasingly complex, and there are continuous improvements in defense systems produced against modern warfare weapons. One of these developments is close-in weapon systems (CIWS) or when translated from Turkish, "closeair defense systems." CIWS includes effective and rapid-response weapon systems designed to protect warships against surface threats. These systems are divided into two groups: missile-based and gun-based systems. A basic CIWS design can be described as placing a weapon system on a radar system. Radar systems used in closeair defense systems vary. In addition to various countries developing these systems, ASELSAN is also developing closeair defense systems in Türkiye.

### **UNITED STATES**

### Phalanx

As with most warfare systems, one of the most used close-air defense systems, especially in NATO countries, is the rotating barrel cannon-based system Phalanx CIWS. Although the prototype of Phalanx, designed by General Dynamics in 1969, was included in the U.S. Navy's inventory in 1973, the first tests of the system were successfully completed on the USS Bigelow destroyer in 1977. Phalanx, whose serial production was approved in 1978, entered active service in 1980 by being integrated into the USS Coral Sea aircraft carrier. The first version

> CIWS includes effective and rapid-response weapon systems designed to protect warships against surface threats.





of Phalanx, which has many variants, used a 20 mm M61 Vulcan rotating barrel gun and a fire control radar measuring in the Ku band.

Produced as a system that can rotate on two axes, Phalanx is an autonomous air defense system that can detect and hit targets autonomously. The first modernization of Phalanx, whose first production version was Block 0, was carried out as Block 1 in 1988. As a result of this modernization, improvements were made in radar, ammunition, computing power and firing rate.

Phalanx received a new mission computer in the Block 1A modernization, and an infrared radar system was integrated into the system in the Block 1B modernization in 1999. Block 0 can move -10/+80 degrees on the vertical axis, Block 1 can move -20/+80 degrees and Block 1B can move -25/+85 degrees. On the horizontal axis, each variant can move -150/+150 degrees. The movement speeds on the axes are 86 degrees per second vertically and 100 degrees per second horizontally in Block 0/1, while they are 115 degrees per second vertically and 115 degrees per second horizontally in Block 1B. While Block 0 and Block 1 can fire 3,000 bullets per minute, Block 1A and Block 1B can fire 4,500 bullets per minute. Phalanx's bullet capacity is 1,550 bullets.

Phalanx, which has an effective range of 1,625 yards (1,486 meters) and a maximum range of 6,000 yards, uses armor-piercing sabot projectiles containing tungsten or uranium as projectiles. Phalanx has a land version called the Land Phalanx Weapon System (LPWS) and was used by the U.S. in the 1991 Gulf War. Phalanx is actively used on Gabya-class frigates in the United Kingdom, Australia, Canada, New Zealand, Bahrain, Chile, Ecuador, Egypt, Greece, India, Israel, Japan, Mexico, Pakistan, Poland, Portugal, Saudi Arabia, Thailand, Taiwan and on Türkiye's TCG Anadolu. It is also used on Bayraktar-class amphibious ships and Akar-class fuel ships.

### **GERMANY**

### **GDM-008**

Regarding close-air defense systems produced by European countries, we can first talk about the systems originating from Germany. The GDM-008, produced by Swiss-based Rheinmetall Air Defense, the air defense division of Rheinmetall, a German-based defense company, is a close-air defense system used by the Danish, Indonesian and Venezuelan navies. The GDM-008, which can provide defense against aircraft, helicopters, UAVs, anti-ship missiles and asymmetric threats from land, was first produced in 1995 and entered active service in 2003. The GDM-008, which has a fire control system with radar and electro-optical systems, uses 35 mm tungsten bullets. The CIWS, which has a four-chamber revolver firing system, can move -15/85 degrees on the vertical axis and 360 degrees on the horizontal axis. The GDM-008 has a vertical axis speed of 70 degrees per second and a horizontal axis speed of 120 degrees per second. In the fast single-shot option, 200 bullets can be fired per minute, while in the automatic



option, this value is 1,000 bullets per minute. The effective range of the GDM-008 is 3,500 meters.

### Sea Zenith

The Sea Zenith close-air defense system features four 25 mm barrels produced by Rheinmetall Air Defense, formerly Oerlikon Contraves. Sea Zenith is operationally available in the world only on the Barbaros (they are being replaced by Phalanx and GÖKDENİZ with the half-life modernization) and Yavuz class MEKO 200 frigates in the inventory of the Turkish Naval Forces. The system, which can fire 800 rounds per minute, includes the Seaguard radar produced by Contravas. The CIWS, which has an effective range of 2 kilometers, can move 360 degrees on the horizontal axis and -14/+127 degrees on the vertical axis.

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The first version of the Phalanx, which now has many variants, used a 20 mm M61 Vulcan rotating barrel gun and a fire control radar measuring in the Ku band.





### ITALY

### DARDO

The DARDO close-air defense system is a CIWS developed by Italian origin Breda and Oto Melara. It consists of two Bofors 40 mm high-density bullet-firing guns, RTN-10X fire control radar and an RTN-20X fire control system. DARDO, whose primary mission is to fend off anti-ship missiles, UAVs and other guided munitions, has two variants: Type A and Type B. The lower part of Type A is 1.3 meters high, and the lower part of Type B is 0.92 meters high. The second difference is that Type-A has an internal magazine with a capacity of 440 bullets and an external magazine with a capacity of 292 bullets, while Type-B has an internal magazine with only 440 bullets. DAR-

> Goalkeeper, which has a GAU-8 30 mm machine gun with seven barrels, uses tungsten penetrating sabot bullets.

DO's firing rate is 600/900 rounds per minute. In addition to these two variants, there is also an improved version of DARDO called Fast Forty, which has a higher firing rate, double magazine and double feeding mechanism. In Fast Forty, Armor Piercing Tail Balanced Sabot (APFSDS) bullets are fired instead of high-density bullets at ranges shorter than 1,000 meters. Apart from

Italy, DARDO is actively used by Algeria, Argentina, Nigeria, Bangladesh, Colombia, Ecuador, Libya, Peru, Malaysia, South Korea, Philippines, Saudi Arabia, Thailand, Venezuela and Vietnam.

### HOLLAND

### Goalkeeper

The Goalkeeper CIWS was designed in 1975 by Thales Nederland, formerly Hollandse Signaalapparaten B.V. It is a close-air defense system designed by the company and started mass production in 1979. Goalkeeper's main mission is to defend autonomously against highly maneuverable ammunition, aircraft and land threats. Goalkeeper, which has a GAU-8 30 mm machine gun with seven barrels, uses tungsten penetrating sabot bullets. The system can move at a speed of 80 degrees per second between -25/+85

degrees on the vertical axis and 360 degrees on the horizontal axis. Capable of firing 4,200 bullets per minute, Goalkeeper has an effective range of 350-2,000 meters. Goalkeeper has two sub-radar systems and detects the target with one of these radars, locking on the target with the other. While the detection radar operates on the 2D I band, the tracking radar utilizes the I and K bands. In 2012, the Dutch government announced that a modernization program would begin, including the renewal of the Goalkeeper closeair defense system's radars, mechanical improvements of the system, new ammunition integration and new elec-

> Meroka, which can fire 1,440 bullets per minute, has a magazine with a capacity of 720 armor-piercing sabots.

tro-optical system integration. In 2016, the first modernized Goalkeeper was deployed on the frigate HNLMS Evertsen. This modernized Goalkeeper features a new control panel and a new mission computer. The ability of multiple modernized Goalkeeper systems to work together in a coordinated manner has also been added to the system as a result of this program.

### **SPAIN**

### Meroka

Meroka is a close-air defense system used by the Spanish navy. Meroka uses two 20 mm 12-barreled Oerlikon (Rheinmetall) machine guns. Although anti-ship missiles are produced for defense against guided missiles, they can also be used against aircraft and land threats. Meroka, developed and produced by Spanish-based FABA Sistemas, can move -15/+85 degrees on the vertical axis and 360 degrees on the horizontal axis. Meroka, which can fire 1,440 bullets per minute, has a magazine with a capacity of 720 armor-piercing sabots. Meroka, which has an effective range of 1,500-2,000 meters, uses the PVS-2 Sharpshooter I-band radar produced by Lockheed Electronics as its radar.

### **SOUTH AFRICA**

### **Denel 35DPG**

Denel 35DPG is a close-air defense system produced for warships by South African Denel Land Systems. The primary mission of the 35DPG is to defend against threats such as helicopters, aircraft and missiles, and its secondary mission is to defend against threats from land. The system, which has been used by the South African Navy since 2005, includes a 35 mm machine gun produced by Oerlikon. The 35DPG's turret has a low radar signature. The system detects targets with search and tracking radar and can also lock on the target with infrared radar and electro-optical systems. The 35DPG, which can operate autonomously, can





bility. GÖKDENİZ, whose ship-based tests were carried out in May 2018, completed all tests successfully. In May 2023, ASELSAN General Manager Prof. Dr. Haluk Görgün announced that GÖKDENİZ was exported to three coun-

tries and there are four candidate coun-

tries. Acceptance tests have been com-

pleted within the scope of GÖKDENİZ's

MİLGEM-5 project.

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be operated by the user via the control panel. The system is able to move at a speed of -10/+85 degrees and 70 degrees per second on the vertical axis. It can fire 1,100 bullets per minute and has two 240 bullet feeding systems of 35DPG. The effective range of 35DPG is 4,000 meters and the maximum range is 6,000 meters.

### TÜRKİYE

### GÖKDENİZ

In Türkiye, Aselsan GÖKDENİZ and GÖKDENİZ-ER, Roketsan LEVENT and MKE are currently working on the 20 mm close-air defense system. Since GÖKDENİZ has just been launched on GÖKDENİZ platforms, we will only discuss this model. The main mission of GÖKDENİZ, which has two 35 mm barrels, is to fend off antiship ships. GÖKDENİZ, which can fire 1,100 shots per minute, can use 35 mm articulated ammunition (ATOM) and classical destructive ammunition at the same time, thanks to the automatic stripless ammunition feeding mechanism. The system has a stabilized tower and includes a fire control radar, electro-optical sensor systems as well as a 3-D search radar. In addition, GÖKDENİZ, integrated with the ADVENT Combat Management System developed by HAVELSAN, also has fully autonomous operating capa-





### RUSSIA

### AK-630

The AK-630 is a close-air defense system developed during the USSR period. The system, which started to be developed in 1963 and the first prototype was completed in 1964, features a 30 mm six-barreled AO-18 rotary cannon. Using high-density particle ammunition and tracer ammunition, the AK-630 can move at -12/+88 degrees and 50 degrees per second on the vertical axis, while it can move 360 degrees and 70 degrees per second on the horizon-



AK-630M2, which achieves vertical movement at 60 degrees per second, can achieve 360-degree movement on the horizontal axis at 80 degrees per second. tal axis. The AK-630 can fire between 4,000-5,000 shots per minute, and uses the MR-123-02 fire control radar and the SP-521 electro-optical tracking system. The effective firing range of the system is 4,000 meters for air targets and 5,000 meters for sea targets.

After the AK-630 entered the inventory in 1976, the problems of the system were corrected and the AK-630M model was developed. The AK-630M entered the inventory in 1979. The AK-306 variant is the version of the AK-630M with an air cooling system integrated into lighter structures. The AK-306, whose feeding mechanism was electric rather than the first versions, did not have a radar system and only had an electro-optical system. After the AK-306 entered the inventory in 1980, a system was developed with two guns named AK-630M1-2 in 1983. The AK-630M1-2, which can fire 10,000 shots per minute thanks to the integration of the second gun into the system, was named AK-630M2 within the scope of modernization in 2007. As a result of modernization, the effective range of the system increased to 5,000 meters and its vertical movement capacity became -25/+90 degrees. The AK-630M2 makes vertical movement at 60 degrees per second and can make 360-degree movement on the horizontal axis at 80 degrees per second. The AK-630, which has the People's Republic of China variant named H/ PJ-13 and the Iranian variant named Kamand, is actively used in Russia, Ukraine, Algeria, Bulgaria, Cameroon, the People's Republic of China, Croatia, Cuba, Egypt, India, Indonesia, Greece, Kazakhstan and Kenya. It is used by Burma, North Korea, Pakistan, Poland, Romania, Slovenia, Vietnam and Yemen.

### Kortik

Kortik, or Kashtan, is a modern close-in air defense system used by the Russian Navy. Kortik, which has two 30 mm six-barrel guns, uses high-density particle ammunition, tracer ammunition and



armor-piercing ammunition. Kortik, which can fire 9,000 shots per minute, also has two launchers that can fire four 9M311 guided ammunition. The effective range of the system is 4,000 meters when using a 30 mm cannon and can go up to 8,000 meters when a missile is used. There is a version of the Kashtan used in Sovremennyy-class destroyers, developed under the name Kashtan-M. Unlike Kashtan, Kashtan-M also has the ability to fire salvos. Kortik, used by Russia, Vietnam and India, is expected to be replaced by the Pantsir-M closeair defense system.

### **Pantsir-M**

Pantsir-M is a close-air defense system designed by Russia to replace the Kortik close-air defense system. Pantsir-M's entry into the Russian Navy inventory continues today. The first ship on which Pantsir-M was deployed was the Odintsovo corvette. It was tested against air targets aboard the Odintsovo corvette in 2020. In later statements, Russia announced that the Pantsir-M system would be integrated into the Admiral Kuznetsov aircraft carrier. Pantsir-M, produced since 2015, has a phased array radar, a friend-foe detection system, and an infrared targeting and detection system. The main weapon system is Hermes-K guided missiles and 57E6 missiles, and the secondary weapons of the system are two 30 mm six-barrel guns.

### **CHINESE**

### Type 76

Type 76 is a close air defense system with two 37 mm automatic cannons of Chinese origin. Type-76, a system developed and produced since the 1970s, can fire 750 shots per minute. The system, which can move -10/+75 on the vertical axis and 360 degrees on the horizontal axis, has a Type 340 fire control radar operating in the I band.

### **Type 730**

Type 730 is a close-air defense system with a 30 mm seven-barreled rotary cannon developed by China. This system has been produced since 2003 and is in active service. It uses the TR47C operating in the I band as a radar and the OFC-3/H/ZGJ-4 electro-optical fire control system. Type-730 can move -25/+85 degrees on the vertical axis and has an effective range of 2,500 meters with armor-piercing ammunition and 3,500 meters with high-density ammunition. Type-730, which can fire 5,800 shots per minute, also has an 11-barreled version called Type-1130 used on aircraft carriers. This version can fire 10,000 shots per minute. Type-730 is used primarily by China, Indonesia, Pakistan and Algeria.

Type-730, which can fire

5,800 shots per minute, also has an 11-barreled version called Type-1130 used on aircraft carriers.





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### 2 Shields for Ukraine's Air Defense NASANS & ASTER

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Ahmet YILMAZ **\*** Defense Researcher

The Russia-Ukraine war, which started on Feb. 22, 2022, continues with increasing and decreasing tempos. The battlefield has become a place where many weapon systems are tested. To ensure Ukraine's air defense, many air defense systems of Western and U.S. origin were or are being sent to the country, including the NASAMS and Aster air defense systems sent by Western countries in the last few months.

### NASAMS

The National Advanced Surface to Air Missile System (NASAMS) is a medium-altitude defense system jointly developed by Norway's Kongsberg Defense & Aerospace and the U.S.based company Raytheon. Three different missiles are used in the system, including Raytheon's beyond visual range (BVR) AIM-120 advanced medium-range air-to-air missiles (AMRAAM) and the advanced medium-range air-toair missile extended range (AMRAAM ER) used by warplanes. In addition to these missiles used for medium altitude, the AIM-9X Sidewinder Block-II short-range air defense missile is also used for low altitude, and the AIM-9X, like AMRAAM, is an air-to-air missile used in warplanes. The B, C5 and C7 models of the AIM-120 AMRAAM missile are used in the system. These same missiles are widely used in warplanes. In this respect, easy-to-access ammunition has been preferred for use in NASAMS. The missile has an active RF guidance system. The same guidance system is also available in the longer-range AMRAAM ER. The AMRAAM ER has a different, more powerful rocket engine.

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The B, C5 and C7 models of the AIM-120 AMRAAM air-to-air missile are used in the NASAMS system.



Thanks to the missile in the ER version, NASAMS provides a 50% increase in range and a 70% increase in altitude.

The AMRAAM ER is a missile designed as a land-based solution, as stated by Raytheon. One reason for the need for a more powerful rocket engine is that it is fired from land. There is a difference in range between launching the same missile from an airborne fighter jet and launching it from a fixed, landbased launcher. The missile launched in the air will have an initial velocity originating from the aircraft, a factor that increases its range.

The AIM-9X Sidewinder Block-II can also be integrated into NASAMS for use in short-range engagements. This IIRguided missile can perform missions at shorter ranges and altitudes compared to AMRAAM. Six missiles can be carried in the launcher, which can be used on the vehicle or stationary. A total of 72 air defense missiles in 12 systems at the battalion level are ready to fire. In addition to the launcher that can carry six missiles, there is also a version that carries two AIM-9X and four AMRAAM missiles. This version, called the High Mobility Launcher (HML), works mounted on 4x4 vehicles. In the

HML, missiles are not inside the canisters. The ammunition is placed on rails, just like airplane wings.

NASAMS uses Raytheon's AN/MPQ-64F1 Sentinel as its radar. The radar, which has a 360-degree coverage area, can detect and track at a distance of 120 kilometers. The radar can track 60 targets simultaneously. The radar, which can be transported towed or mounted on a vehicle, can also be transported by helicopter. Instead of the Sentinel Doppler radar, the GhostEye MR active electronically scanned array (AESA) radar, which uses newer technologies, was developed.

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Thanks to the AMRAAM-ER missile, NASAMS' range is increased by 50% and its altitude by 70%.



Control of missile launchers, Sentinel radar and electro-optical sensors is provided by the fire distribution center (FDC) developed by Kongsberg. Thanks to this control unit, NASAMS can work in harmony with other systems in the layered air defense umbrella that includes different systems. The FDC provides control of the Naval Strike Missile Coastal Defense System (NSM CDS), another weapon system developed by both NASAMS and Kongsberg. The NSM CDS is an anti-ship coastal defense system that can be launched from a vehicle-mounted launcher.

### ASTER

Aster is an air defense system developed by Eurosam, owned by MBDA. MBDA, a defense industry organization jointly established by British, Italian and French companies, works on guided munitions and currently operates in France, England, Italy, Germany







and Spain. Missiles with two different ranges were developed for the Aster air defense system. Thanks to the ammunition offering different ranges, Aster has air defense capability at both medium and high altitudes. Aster 15 missiles are used as a medium-altitude air defense with an altitude of 13 kilometers (8 miles) and a range of 30 kilometers. The 4.2-meter-long (13.7-footlong) missile weighs 310 kilograms (685 pounds). The missile, which has solid fuel and a two-stage engine, can accelerate to three times the speed of sound. Another capability of the Aster air defense system, the medium- and high-altitude air defense missile Aster 30 missile has an altitude of 20 kilometers and a range of 120 kilometers. The 4.9-meter-long missile weighs 450 kilograms. Like Aster 15, Aster 30 also has a solid fuel and two-stage rocket engine. With this engine, Aster 30 can reach a speed of 4.5 times the highest speed. Apart from Aster 15 and 30, Aster 30 B1 and Aster Block 1 NT missiles are ammunition capable of intercepting ballistic missiles. Aster air defense missiles can be launched from the Sylver A-43 and A-50 vertical launching sys-

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The Aster 30 missile, like the Aster 15, has a solid fuel and two-stage rocket engine.

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tems (VLS) developed by France. With this feature, it is a preferable system for naval platforms. The 4.2-meter-long Aster 15 missile can be launched from the A-43 vertical launch system. Since the A-43 cannot carry ammunition longer than 4.35 meters, the Aster 30 missile cannot be carried in this launcher. The A-50 launcher, which can carry ammunition under 5.05 meters long, is suitable for the 4.9-meter-long Aster 30 missile. As a missile with an active RF seeker, it can intercept missiles at supersonic and subsonic speeds. In addition, Aster missiles can be used to intercept anti-radiation missiles, which pose a great threat to air defense systems. Anti-radiation missiles neutralize air defense systems by following the signals of the air defense missile's radar. To counter this threat, air defense systems do not keep their radars on all the time and leave the area after firing. In addition to these, warplanes, helicopters and unmanned aerial vehicles are also Aster's common targets.

## Diesel-Electric Submanines

Ahmet YILMAZ 🐀 Defense Researcher

ropulsion systems used in military submarines are designed to provide long periods of submerged operation without needing to resurface to refuel. In diesel-electric submarines, movement is provided by both diesel and electric motors, with the propeller located at the back of the submarine rotated by an electric motor. The diesel engine produces electricity that is stored in batteries and used to operate the motor. Despite their many positive features, fuel consumption is often criticized as inefficient in diesel-electric submarines due to energy losses in energy conversion.

The submarine's diesel engine must have access to an air supply to run and charge the batteries. While the submarine is on the surface, the diesel engine can use air from the atmosphere and while submerged, the system can take in air through a system called a snorkel. The snorkel works like a periscope, allowing the submarine to charge its batteries by providing its diesel engine with an air supply without having to fully surface. A risk to the platform's stealth and a definite downside, there is always the possibility that the exhaust gas released while the diesel engines run may be detected during snorkeling. In addition, the wave created by the snorkel on the water's surface as the submarine navigates underwater is another factor that risks detection.

> Diesel-electric submarines are smaller than their nuclear counterparts. They also have a simpler drive system and are, therefore, cheaper and more widely used. Their electric motor also makes them much quieter than nuclear submarines.

In addition to the possibility of detecting the submarine due to the snorkel when the sea is calm, rough sea conditions also pose hazards. It is preferable to keep as little of the snorkel on the surface as possible to reduce visibility. When waves cause a constant change in the level of the sea's surface relative to the submarine, the tip of the snorkel can sink below the surface, making it ineffective. To prevent this, the end of the snorkel can be sealed with float-locking mechanisms or electronic systems via sensors. However, a lack of airflow could cause the submarine's diesel engine to suddenly stop working. At the same time, personnel may feel pain in their eardrums due to sudden changes in the air pressure inside the submarine. To prevent this, compressed air is also used in cases where the vessel is cut off from the surface.

Despite the setbacks, diesel-electric submarines are smaller than nuclear submarines, have a simpler drive system and are quieter thanks to their electric motor. Therefore, they are cheaper and more widely used.

### **TYPE 209**

Designed by German shipbuilder ThyssenKrupp Marine Systems (TKMS), the diesel-electric submarine has five different models: Type 209/1100, Type 209/1200, Type 209/1300, Type 209/1400 and Type 209/1500. The Type 209 series first entered service in the Greek navy in 1971 and is currently in the inventory of many armies, including the Turkish navy. So far, 68 Type 209 submarines have been produced, and 59 of these submarines are in active use. Indonesia experienced one of the most significant losses of the Type 209 after a Type 209/1300 was lost during a military exercise.

According to the models of the Type 209 submarine, its submerged displacement range is 1,207, 1,285, 1,390, 1,586 and 1,810 tons. Their lengths are, respectively, 54.1, 55.9, 59.5, 61.2 and 64.4 meters.

Type 209 submarines have four German MTU-produced diesel engines. The batteries are charged with four AEG generators connected to diesel engines.





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The electrical energy of the Type 209 submarine is stored in a total of four 120-cell batteries, one for each generator. Unlike other models, the batteries in the Type 209/1500 model are 132 cells. The submarine has an electric motor and propeller. Type 209 submarines can reach a speed of 11 knots (20 kph) on the surface and 22 knots submerged. It can dive up to hundreds of meters underwater. While it can reach a range of 700 kilometers (435 miles) at a speed of 7 kph while submerged, it can operate for 50 days without resupply.

Type 209 series submarines, which are generally equipped with eight 533 mm torpedo tubes, can carry 14 rounds of ammunition. In addition to

> All submarines in the Turkish and Greek navies consist of the German-made Type 209 and 214 series.

various models of torpedoes, they also have mine and UGM-84 harpoon antiship missile capabilities. UGM-84s can be fired from a 533 mm torpedo tube. The ammunition is in a special casing so it can be fired from the submarine below the surface. It is fired from the torpedo tube inside the casing and when it reaches the surface, the casing cover automatically separates. The solid-fuel rocket booster portion of the ammunition is then ignited. Thus, the ammunition is released from the casing and moves toward its target in the air by opening its wings.

The navies of Argentina, Brazil, Chile, Colombia, Ecuador, Egypt, Greece, India, Indonesia, Peru, South Africa, South Korea, Venezuela and Türkiye are active users of the Type 209. A total of 12 Type 209 submarines, four in each class, are in service in the Turkish navy in three classes: Ay, Preveza and Gür. While the number of Moon-class submarines was six, four remained after the retirement of two. The Preveza and Gür-class submarines are Type 209/1400 and the Ay class are Type 209/1200. In addition, the Turkish navy's submarines are being modernized under the leadership of STM. Within the scope of the modernization projects in question, with the integration of the Müren Combat Management System into the submarines, the national torpedo became capable of being fired from AKYA submarines.

The Dolphin Class submarines built for the Israeli navy were initially based on the Type 209 submarines and were named Dolphin-I class. These submarines, which had a submerged displacement of 1,900 tons and a length of 57.3 meters, were followed by the longer Dolphin-II-class submarines. The Dolphin-II class has a submerged displacement of 2,400 tons and a length of 68.6 meters. Unlike the Type 209, Dolphin-class submarines have three diesel engines, also produced by MTU. The Israeli navy will replace the first received Dolphin-I-class submarines with new submarines called Dakar class.

### **TYPE 214**

Type 214, like Type 209, was developed by TKMS. Although it is a diesel-electric submarine, Type 214 submarines have air-independent propulsion (AIP) capability. Thanks to this feature, the submarine can stay underwater for approximately three weeks without the need for a snorkel and thus maintain its stealth for an extended period. The construction of the first submarine started in 2001, and this submarine was delivered to the Greek navy in 2010. The submarine, which is actively used in the navies of Greece, South Korea and Portugal, will enter the inventory of the Turkish navy this year under the Reis class in the Type 214TN (Turkish navy) configuration. A total of 15 submarines are on active duty, including four in the Greek navy, nine in the South Korean navy and two in the Portuguese navy. The construction of TCG Piri Reis, the first of the submarines to be delivered to the Turkish navy, has been completed. The TCG Piri Reis (S-330) is still undergoing its acceptance tests. The construction and testing of the other five submarines continues at Gölcük Shipyard.

Since the Type 214 is an export-oriented platform designed by the German TKMS, just like the Type 209, the construction processes of these submarines are generally carried out in cooperation with the purchasing country. In addition, changes are made to the submarines in line with the requests of the navy that made the purchase. Among the platforms built and under construction so far, except for the Greek navy's HS Papanikols (S-120) and the Portuguese navy's two submarines, the platforms are manufactured or have been produced in the purchasing countries. Therefore, the integration of subsystems produced by the purchasing party itself is optional. As

a result, although the size and weight of the submarine may vary depending on the requirements, on average it has a length of 65 meters and a displacement of 1,860 tons when submerged.

Type 214 submarines have two German MTU-produced 16V-396 diesel engines. The batteries are charged with two Piller Ntb56.40-10 generators connected to the engines. The electrical energy of the Type 214 submarine is stored in a total of two batteries, one for each generator. The submarine has a Siemens Permassium electric motor and propeller. Type 214 submarines

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Although it is a dieselelectric submarine, Type 214s have airindependent propulsion (AIP) capability.



can reach speeds of 10 knots (18.5 kph) on the surface and 20 knots submerged. While it can reach a range of 780 kilometers at a speed of 15 kph while submerged, it can serve for 84 days without resupply. When run-

ning on the capacity of its fuel cells, it offers a range of 2,310 kilometers at a speed of 7 kph.

The submarine's propeller has a design that reduces the effect of cavitation. Cavitation is a process that creates steam bubbles as the pressure of the water around it changes during the

> The Kilo class has a propulsion system consisting of two 1,000 kW diesel generators and one 5,100 kW electric motor.

rotation of the propeller. The explosion of these air bubbles creates sound and causes wear on the propeller. This occurrence is reduced by designing propellers with more blades that rotate at lower speeds. In addition, thanks to such designs,

the sound produced by the steam bubbles during the operation of the fan is reduced, making outside detection more difficult.

### **KILO CLASS**

Kilo-class submarines developed by Russia began to be used in the 1980s under the name Project 877 during the Soviet Union era. The Kilo class, which was subjected to various renovations such as sonar systems in the mid-'90s, was named Project 636. Later, models produced after 2010 were called Project 636.3. With the changes made to the combat systems and engines of these models, the submarines took on





their most advanced form. Sixty-four Kiloclass submarines are actively used in the navies of Algeria, China, Myanmar, Poland, Iran, Russia and Vietnam. INS

Sindhurakshak (S63), a Project 877 Kilo-class submarine belonging to the Indian navy, was decommissioned in 2010 due to a fire caused by its battery. It has a length of 70 to 74 meters, depending on the Kilo-class model, and a displacement of 3,000 to 4,000 tons when submerged.

The Kilo class has a propulsion system consisting of two 1,000 kW diesel generators and one 5,100 kW electric motor. Changes have been made to the submarine's propeller depending on the model over the years. While the propeller of the Project 877 Kilo-class submarines, which first entered service in the '80s, consisted of six blades, a design with seven propellers was adopted in the



Project 636 submarines, which started to enter service in the mid-'90s, with changes made to the propeller.

The Kilo class, which has six 533 mm torpedo tubes, can also use various guided munitions in addition to torpedoes. Kalibr can use cruise missiles by launching them with capsules, just like the UGM-84 Harpoon missile. The VA-111 Shkval, a very fast-moving torpedo, can also be launched from Kiloclass submarines. Working with a technique called supercavitation, these torpedoes achieve underwater speeds that other torpedoes cannot reach and perform their mission without allowing the target to take precautions. The torpedo is less affected by friction as its contact with water is cut off as it moves in the gas bubble created by the turbine at the nose of the torpedo. It also reaches a speed of 200 knots (370 kph) thanks to its solid-fuel rocket engine.

### **SCORPÉNE CLASS**

Scorpène-class submarines, jointly developed by Spanish Navantia and French Naval Group companies, serve in the navies of Chile, India, Malaysia and Brazil. Ten submarines are on active duty and two are under construction. The CM-2000 model, which has a diesel-electric propulsion system, has a displacement of 1,565 tons and a length of 61.7 meters. The AM-2000, a model with an air-independent propulsion system, is 70 meters long and has a displacement of 1,870 tons.

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The construction of 12 Söryü-class submarines was completed between 2005 and 2019 and delivered to the Japanese Maritime Self-Defense Force.



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The submarine has six 533 mm torpedo tubes and can carry 18 torpedoes. It can also use the A3SM model, which is the submarine version of the SM-39 Exocet anti-ship and MICA air defense missile. The fact that the A3SM missile can be used gives the submarine an advantage, especially against anti-submarine helicopters. By detecting the waves emitted by the helicopter dipping sonar, the submarine can use this air defense missile to defend itself. It can be fired from a 533 mm torpedo tube with the capsule used to fire other cruise missiles. When it reaches the water's surface, it initiates its engine and moves toward the helicopter traveling at a low altitude.

### SÖRYÜ CLASS

Sōryū-class submarines, built by Japan's Mitsubishi Heavy Industries and Kawasaki Shipbuilding Corporation, have been in service with the Japanese Maritime Self-Defense Force since 2009. The construction of a total of 12 submarines was completed between 2005 and 2019 and delivered to the Japanese Maritime Self-Defense Force. The submarines have a submerged displacement of 4,200 tons and a length of 84 meters.

Ōryū (SS-511) and Tōryū (SS-512), which entered service in 2020 and 2021, have a propulsion system using lithium-ion batteries. The other 10 submarines, which entered service between 2009 and 2019, use two Kawasaki-produced diesel engines and four Stirling engines designed by the Swedish company Saab Kockums, produced by Kawasaki under license. Stirling engines enable submarines to remain submerged for longer periods of time. The Taigei class is a submarine class that Japan developed after the Sōryū class.

### **TYPE 039 (SONG CLASS)**

Type 039 submarines have been in service with the Chinese People's Liberation Army's navy since 1998. All of the 13 submarines produced in total are on active duty. There is also a version of these submarines called Type 039G, which differs in turret design compared to Type 039. Type 039 submarines have a submerged displacement of 2,250 tons and a length of 74.9 meters.

After Type 039, China is developing Type 039A (Yuan class) to replace Type 033 (Romero class) and Type 035 (Ming class) submarines. Type 039A is 77.6 meters long and has a displacement of 3,600 tons submerged. There are four different versions: 039A, 039AG, 039B and 039C. There are differences between these models resulting from various improvements in body design. Flank array sonar is integrated into submarines with the Type 039B model, with side array sonar placed along the sides of the submarine along its length.

The Type 039A submarine also achieved export success. These submarines were sold to the Pakistani and Thai navies. Four of these submarines, called Pakistan's Hangor class, were built in China and four in Pakistan.

An effective military tool, it is clear hundreds of submarines equipped with different propulsion systems will continue to be one of the main striking forces in the inventory of the world's navies.



Type 039 submarines have been in service with the Chinese People's Liberation Army Navy since 1998.





### Innovation in its DNA





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ERMAC