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DEFENCE TURKEY

SOLOTURK CELEBRATES ITS 10TH ANNIVERSARY

ASELSAN'S NEW ELECTRO-OPTICAL SOLUTIONS FOR NATIONAL UAV PLATFORMS

PN-MILGEM CORVETTES TO BE ARMED WITH MBDA'S ALBATROS NG NBAD SYSTEM!

THE S-80 PLUS SUBMARINE PROGRAM

10TH ANNIVERSARY

SOLOTURK DEMO TEAM

2011 - 2021

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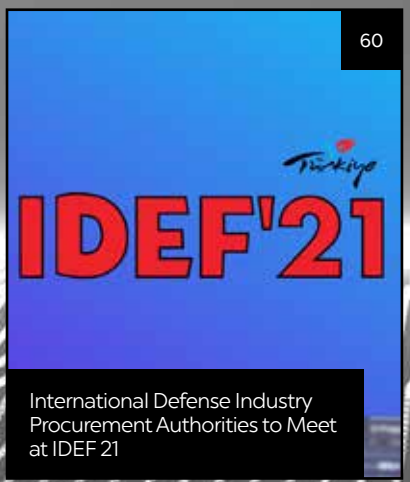

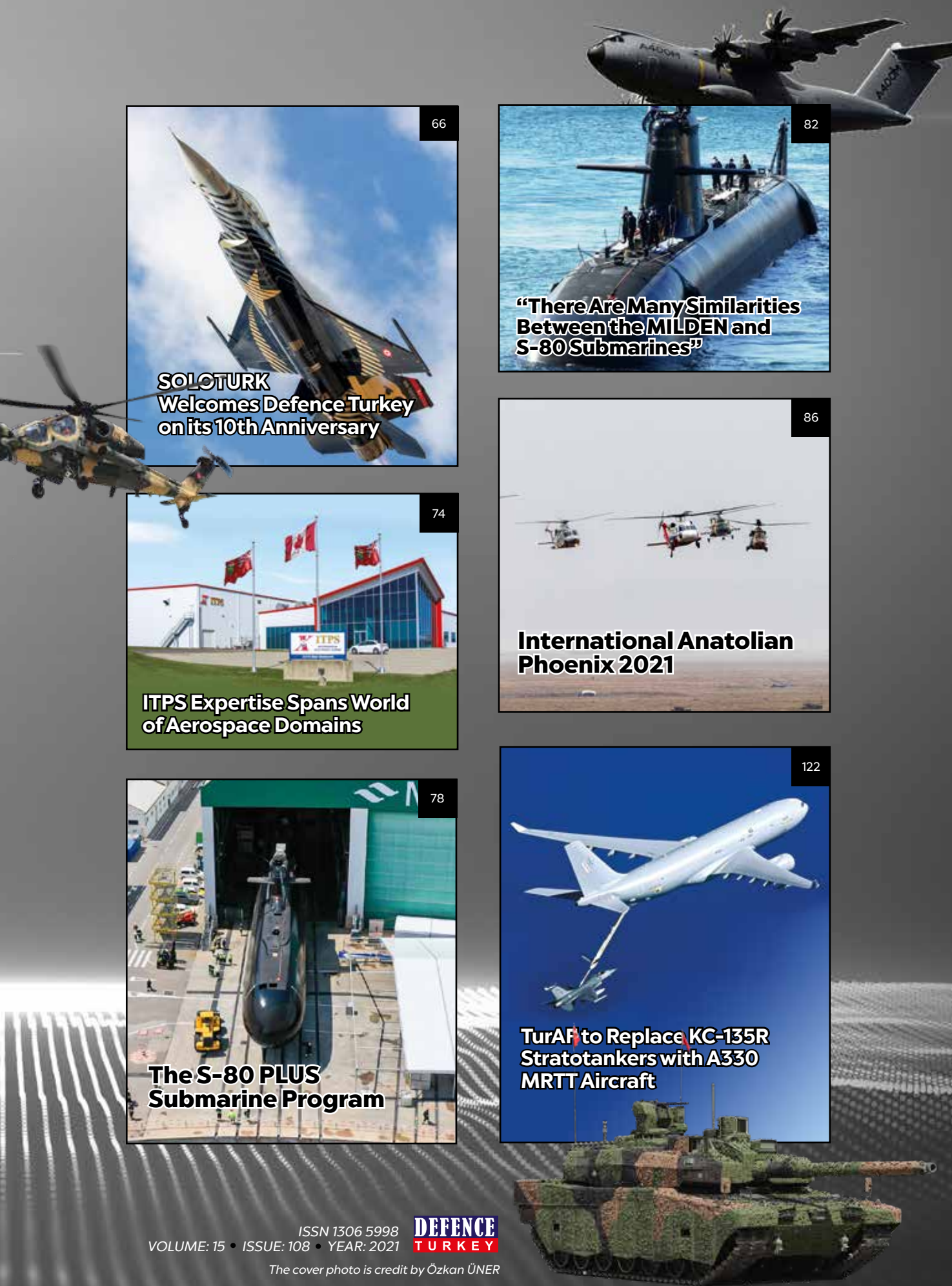

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SoloTurk Celebrates its 10th Anniversary in the Sky!

Ayşe AKALIN
Publisher & Editor in Chief

SOLOTURK is a Demonstration Team, which presents the capability of the modern and high-performance F-16 aircraft possessed by Turkish Air Force and the high level of skill and knowledge necessary for its use to the audience as a show. The demonstration flights are realized with a solo F-16C Block 40 aircraft.

Having been formed to celebrate the 100th anniversary of the Turkish Air Force (TurAF) and performed in front of crowds for the first time on April 15, 2011 before making their international debut at the TurAF's 100th anniversary show at Izmir during June 4-5, 2011, TurAF's world known solo air display team SOLOTURK is celebrating its 10th anniversary throughout 2021 with several events.

With the special permission obtained from the Turkish Ministry of National Defense (MoND), Defence Turkey visited the SOLOTURK Team at their home, the 132nd Weapons and Tactics Squadron Command of the 3rd Main Jet Base Command in Konya. We asked the SOLOTURK Team about everything that our readers have wanted know about them. Of course, we also had the opportunity to closely view the special paint changes made on the aircraft for the 10th anniversary, and we got some great shots. In the past 10 years, there have been hundreds of demonstration flights (more than 200 shows in 15 countries and over 60 cities), many memories, and changing teammates, but the only thing that doesn't change is that SOLOTURK shines bright like a star in the sky. 10-year anniversaries have always been special. It is a significantly important step towards permanence. As Defence Turkey family we wish happy 10th anniversary to SOLOTURK. Keep flying high and shine in the skies!

You can read our exclusive article about our visit to SOLOTURK Team, decorated with breathtaking photographs, in this issue...

Meanwhile, despite COVID-19 Pandemic, Turkish Defence & Aerospace Sector has managed to increase its exports by 45.5% during first 6 months of 2021. Export sales have vital importance for the sustainability of the industry. As per the monthly export data announced by the Turkish Exporters Assembly (TIM), Turkish Defence and Aerospace Industry exports has increased 3.7% in January, 34.1% in February, 74.6% in March, 47.8% in April, 51.6% in May and 32.6% in June compared to the same period of the previous year, despite the negative effects of the COVID-19 pandemic.

According to TIM data, the Turkish Defence and Aerospace Industry realized US$$166.997 Million in defence and aerospace equipment exports in January, US$233.225 Million in February, US$$246.973 Million in March, US$302.516 Million in April, US$170.346 Million in May and US$221.791 Million in June. According to TIM's data, while the Turkish Defence and Aerospace Sector achieved some 29% increase in exports in June 2021 compared to the previous month, during January 1st – June 30th of 2021, the Turkish Defence & Aerospace Sector has managed to increase its exports by 45.5% to US$1.341.848 Billion level compared to the US$922.528 Million realised during the same period in 2020.

According to TIM figures the list of the top 15 countries that imported defence and aerospace products from Turkey during January 1st – June 30th of 2021 is composed of; the U.S.A., Azerbaijan, the UAE, Germany, Bangladesh, Tunisia, the UK, Uzbekistan, China, Jordan, Rwanda, Russian Federation, Qatar, Poland and the Netherlands.

Providing more efficient, low cost, combat proven, and less problematic NATO-standard high-tech products for arms buyers, Turkey emerges as a new arms exporter. Export revenues are expected to increase further in 2021 and even exceed 2019 (US$2.740,144 Billion according to TIM data), which closed at record high.

Enjoy this issue...

Major General Sergei SIMONENKO: *"We Could Take Certain Steps Towards Building up Our Contacts and Strengthening, Among Other things, Military-Technical Cooperation Between the Defense establishments of Our States."*

An interview with Major General Sergei SIMONENKO - Deputy Minister of Defense for Armament, Chief of Armament of the Armed Forces of the Republic of Belarus

Defence Turkey: As the National Armament Director / Chief of Armament of Belarus how would you explain your job and official duties? How would you sum up your role?

Major General Sergei SIMONENKO: In general, the Deputy Minister of Defense for Armament, Chief of Armament of the Armed Forces is entrusted with a wide range of duties: participation in making decisions on the further development of the Armed Forces in terms of equipping them with modern weapons, military and special equipment, including organizing the formation of proposals from the Ministry of Defense for the State Armament Program and the State Defense Order; organization of supply of the Armed Forces with weapons, military and special equipment, missiles, ammunition and military-technical property; management of the technical support of the Armed Forces in the course of their daily activities, training for the intended purpose and in the event of repulsing aggression – in wartime; organization of the correct operation of weapons, military and special equipment, including bringing them to the established degree of combat readiness, maintaining the established degree of readiness for their intended use by monitoring their technical condition, carrying out maintenance and routine repairs, organizing their high-quality storage, transportation, training of personnel on the operation and repair of weapons, military and special equipment; organization of restoration of faulty weapons, military and special equipment, support of modernization and creation of new models; ensuring the safety of weapons, military and special equipment, missiles, ammunition, creating safe conditions for their containment; supervising the command-and-control bodies and military units of technical support subordinate to the service (organizing their operational and combat training, solving tasks to ensure the training of the Armed Forces).

The role of the Chief of Armament of the Armed Forces is primarily to maintain the combat readiness of the Armed Forces when it comes to serviceable weapons, military and special equipment in the ranks, and the provision of missiles and ammunition.

Defence Turkey: Could you please provide some key facts about the Ministry of Defense of the Republic? Could you elaborate on the structure, responsibilities and number of personnel working at the Armament Directorate?

The panoramic view of preparation for Parade on the Victory Day of Belarus, 8th May, 2020, Belarus, Minsk

SU-30SM Multi-Role Fighter

Major General Sergei SIMONENKO: The Armament of the Armed Forces includes seven structural divisions. They are collectives of officers and civilian personnel numbering from 10 to 25 people.

The Armaments Headquarters of the Ministry of Defense carries out general planning of the technical support of the Armed Forces in peacetime and in wartime, the development and coordination of the implementation of the Plan for the construction and development of the technical support system of the Armed Forces, planning and carrying out training activities for the purpose of command-and-control bodies and military units of technical support of the Armed Forces.

The Missile and Artillery Armament Division, the Armored Division and the Automobile Division are the supplying bodies of the Armed Forces. They provide troops with appropriate types of weapons, military and special equipment, missiles, ammunition, organize the accumulation and maintenance of established stocks of materiel, issue military-technical equipment to the troops to ensure the operation and repair of weapons, military and special equipment, issue missiles and ammunition for combat training activities, supervise directly subordinate arsenals, bases and depots of weapons and ammunition.

Tasks for the implementation of state purchases of weapons, military and special equipment and military-technical property, preparation of proposals from the Ministry of Defense to the State Defense Order, for the implementation of military-technical cooperation of the Ministry of Defense of the Republic of Belarus with other states and international organizations, as well as the implementation of tasks in the field of export control is entrusted to the division of the procurement and repair of weapons and military equipment of the Armed Forces.

Functions of the Ministry of Defense in organizing the operation and comprehensive military repair of weapons, military and special equipment of the Armed Forces, coordinating the technical support of combat alert, organizing work on standardization and metrology in the Armed Forces, participating in the development and implementation of state programs in the field of ensuring the safe storage and disposal of weapons, military and special equipment, military-technical property, ammunition, as well as control over the timely disposal of ammunition and their components is implemented by the Division of Operation and Repair of Arms and Military Equipment of the Armed Forces.

Analysis of global trends in the development of weapons, the formation of proposals from the Ministry of Defense for the State Armament Program, support of research and development work on the modernization of existing and creation of new models of weapons and military equipment, as well as interaction on the development of modernization and the creation of new models with representatives of republican government bodies and enterprises of the defense sector of the economy of the Republic of Belarus is entrusted with the division of the development of weapons systems of the Armed Forces.

This structure is quite harmonious, efficient and allows solving the tasks facing the armament of the Armed Forces with high quality.

Defence Turkey: What can you tell us about the Belarus defense procurement process? Does Belarus undertake defense procurement through a centralized defense organization within the country´s Ministry of Defense or through a separate government organization as in Turkey?

Major General Sergei SIMONENKO: In the Republic of Belarus, the defense procurement procedure is carried out in strict accordance with the current legislation: The Civil Code of the Republic of Belarus and the Law of the Republic of Belarus "On State Procurements".

In our country, there is no separate government organization responsible for the procurement of military products. The Ministry of Defense, as well as other law enforcement

agencies of the state, has its own body of military administration - the department of the procurement and repair of weapons and military equipment of the Armed Forces, subordinate to the Deputy Minister of Defense for Armaments - the Chief of Armaments of the Armed Forces and carry out centralized purchases of weapons, military, and special equipment within the framework of the Armed Forces. This greatly simplifies the procurement process itself and reduces the time spent on it.

The purchase of military products is carried out by announcing a tender (request for price proposals), or by organizing an open electronic auction.

Defence Turkey: Decision making about arms procurement and deployment is a political process. Can you elaborate on the decision making (bidder and product selection) process that applied at defense tenders / procurement in Belarus?

Major General Sergei SIMONENKO: In the Republic of Belarus, the process of public procurement of military products is a rather well functioning and transparent mechanism, which is divided into several stages: procurement planning, procurement procedure and conclusion of a contract based on the results of the procurement procedure.

Public procurement planning in the Ministry of Defense is carried out through the formation, approval, and maintenance of an annual public procurement plan. So, annually, based on the needs of the Armed Forces, the Ministry

of Defense draws up an annual public procurement plan for the coming year. After its approval by the Minister of Defense, the plan is posted in the public domain on the electronic trading platform, except for information constituting state secrets.

The posted annual public procurement plan is the basis for conducting public procurement procedures. After that, within the established time frame, the Division of Procurement and Repair of Arms and Military Equipment of the Armed Forces summarizes proposals from potential suppliers of goods and services.

To consider the proposals received for compliance with the established requirements, to evaluate and compare them, a commission has been formed in the Ministry of Defense, which, according to the established criteria, determines the winning participant, and makes the decision on the public procurement. The final stage is the conclusion of a contract based on the results of the procurement procedure.

Defence Turkey: What can you tell us about the national defense policy of Belarus?

Major General Sergei SIMONENKO: The Republic of Belarus proceeds from the fact that none of the states is not an enemy.

Our country condemns any military conflict as a means of implementing policy and adheres to the principle of the peaceful settlement of disputes.

At the same time, the Belarusian state will defend its national interests using all available means, including through the use of military force, and reserves the right to take a set of preventive measures of strategic containment in order to prevent an attack or neutralize an internal armed conflict.

T-72B3 MBTs are seen during the military exercises, Minsk, Belarus, 2019

Yakovlev Yak-130 Training Aircraft of Belarus Air Force seen at Dyagilevo Airfield during Aviadarts contest

The use of military force is viewed as an extreme measure after all the possibilities for taking political, diplomatic, legal, economic, informational, ideological, and other measures to ensure military security have been exhausted.

Defence Turkey: Can you elaborate on the constitutional task of the Armed Forces of Belarus?

Major General Sergei SIMONENKO: The Armed Forces of the Republic of Belarus is intended to ensure military security and armed protection of the Republic of Belarus, its independence, territorial integrity, sovereignty, and constitutional order.

Defence Turkey: As the Chief of Armament, you are responsible for national defense developments and for coordinating force modernization. So, your task is closely related to the implementation of the 2016-2020 State Armament Program. Can you elaborate on the results of the 2016-2020 State Armament Program? What has been achieved under the Program? Are you satisfied with the results?

Major General Sergei SIMONENKO: I believe that the goal of the state armament program for 2016-2020 has been achieved.

The implementation of the measures of the state program made it possible to equip the units of the Armed Forces with modern models of weapons, military, and special equipment, to increase the combat potential of the Armed Forces, the efficiency and reliability of command and control, capabilities for radar, radio-technical and electronic reconnaissance, electronic warfare, personnel protection, unit mobility.

As part of the implementation of the State Armament Program, multirole fighters Su-30SM were delivered to the troops in a planned manner, Yak-130 operational trainer, Mi-8MTV-5 helicopters, Polonaise multiple launch rocket systems, T-72B3 tanks, BTR-70MB1 armored personnel carriers, Tor-M2 anti-aircraft missile systems, Cayman armored vehicles, Rosa-RB-M, Sopka-2, Protivnik-G radar systems, radio relay stations and unmanned aerial vehicles of various modifications, a large number of personal protective equipment for military personnel and other modern highly effective weapons and equipment, weapons, military and special equipment in service with the Armed Forces.

Mi-8MTV-5 Helicopters

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Also, at the expense of the funds allocated under the state armament program, the tasks of maintaining serviceability and restoring the resource of the existing fleet of weapons, military and special equipment were solved. Besides the optimal expenditure balance on maintaining the weapons in combat readiness and the cost of their development is provided.

In general, I am satisfied with the results of the implementation of the state armament program for 2016-2020.

Defence Turkey: When will the State Armament Program for 2021-2025 be submitted for approval?

Major General Sergei SIMONENKO: The State Armament Program for 2021-2025 has already been developed, approved by the Decree of the President of the Republic of Belarus and, to this date, it has already begun to be implemented.

To develop this topic I can add, that in the nearest (upcoming) 5-year plan, main attention will be paid to further increasing of the combat effectiveness of the Armed Forces by consistently automating troops and armament process-control systems, increasing the combat capabilities of missile forces and artillery, ground forces and special operations forces, introducing unmanned aerial vehicles, improving communication and navigation support systems.

Provitnik GE Radar

Defence Turkey: What can you tell about Belarus´ 2021 defense budget?

Major General Sergei SIMONENKO: The Defense establishment of every state would always like to have a budget larger than what is actually allocated by the state. At the same time, the military leadership understands that the allocated budget must be within the limits of reasonable sufficiency. I think that the defense budget of the Republic of Belarus is aligned exactly with this category. It allows not only maintaining the existing combat potential of the Armed Forces, but also systematically developing it. In addition, if such a need arises, the country's leadership who pays considerable attention to ensuring the state's defense potential, may take separate decisions on financing certain measures in the interests of the Armed Forces. Therefore, as Deputy Minister of Defense for Armament, I think that the defense budget for 2021 is sufficient.

Defence Turkey: Can you list the most important procurement programs for Belarus and their envisaged time frames?

Sopka-2 Radar Systems

Major General Sergei SIMONENKO: For the Republic of Belarus, the most important program in the field of procurement and armament modernization, military and special purpose equipment is the State Armaments Program, which is developed every 5 years and is implemented through the accomplishment of the annual State Defense Order.

Also, in terms of ensuring the safety of storage and the required conditions for keeping stocks of arsenal, missiles, ammunition and military-technical equipment, recycling of non-usable ammunition. Last year we completed

the implementation of two state programs: The State Program for ensuring the safe storage of armament, military and special purpose equipment and a State program for the recycling of non-usable armament, military and special purpose equipment and ammunition.

The implementation of measures of these state programs made it possible to guarantee the safe storage of stocks of armament, missiles and ammunition in the arsenals and bases of the Armed Forces, significantly improve the conditions for keeping armaments, military and special purpose equipment, missiles and ammunition through the repair and construction of storage depots, optimize the procedure for placing logistic stocks, to improve the quality of maintenance and the efficiency of repairing of armaments, military and special purpose equipment by equipping arsenals and armaments bases, military maintenance and repair points with modern production technological equipment.

The current State Armament Program for 2021-2025 is aimed at further improving and updating the existing fleet of armaments and equipment, maintaining the forces and means of the entire technical support system at a level that ensures a quick and high-quality accomplishment of tasks according to the intended purpose.

Defence Turkey: The COVID-19 pandemic has caused a huge global disruption to critical defense operations and programs. How did Belarus conduct defense and security procurements in the context of COVID-19 in 2020?

Major General Sergei SIMONENKO: Of course, as we can see from the media, the COVID-19 pandemic has led to a certain decline in the economic level in many countries and resulted in the failure to implement a number of projects, as countries were forced to take appropriate measures to stabilize the economic situation.

I would like to note that, thanks to the political course and tactic of actions to combat COVID-19 chosen in the Republic of Belarus, the pandemic did not significantly influence the implementation of planned measures in the field of procurement and modernization of armaments and military equipment for the Armed Forces.

We maintain close contacts with both domestic military manufacturers and our Russian colleagues. These contacts actually, did not stop.

In August 2020, a delegation of our Armed Forces and industrial enterprises of the defense sector of the economy of the Republic of Belarus took an active part in the international military-technical forum "Army-2020", held in the Russian Federation where a number of contracts were signed for the further supply of the Armed Forces of the Republic of Belarus of modern peace's of armament, military and special purpose equipment of Russian production.

This year, the technical equipment of the Armed Forces also continues as planned, without any adjustments.

Defence Turkey: What is the domestic defense industry like currently? Could you provide some key facts about the military industry of the Republic of Belarus for our readers? Are there both state-run and private companies in the Belarus Defense Industry Sector or are 100% of all enterprises operating in the Belarus defense sector state-run?

Major General Sergei SIMONENKO: The defense industry in the Republic of Belarus is supervised by the State Authority for Military Industry, therefore, the question of the functioning of the defense sector of the economy should be addressed to representatives of this department. I can add that we are very closely cooperating with our State Authority for Military Industry in all areas, especially those that are traditionally strong in our republic - communications, automated process-control systems, radar ranging, electromagnetic warfare and others.

Answering on the second part of the question, I will add that there are no restrictions on the participation of private enterprises in tenders for the development and supply of armaments, military, and special purpose equipment for the Armed

The 4×4 armoured reconnaissance vehicle "Cayman" are in service for the Belarus Ground Forces. The vehicle can be used in reconnaissance and sabotage missions, patrol, escort, peace-keeping and police operations, as well as in emergency response missions.

© Belarus MoD

Forces of the Republic of Belarus. In our state, all interested enterprises of any form of ownership, in absolutely equal conditions, have the right to take part in and participate in tenders held by the Ministry of Defense to determine supplies of military goods. The main requirement is that all participants in the procurement procedure meet the requirements of the current legislation of the Republic of Belarus, and they must have all special permits to carry out activities related to military goods.

MILEX 2021 exhibition was held on 22-25 June, Belarus, Minsk.

Defence Turkey: How do you evaluate the current state of Belarusian-Turkish cooperation in the field of defense? What do you think could be done to increase the level of this cooperation? What is your forecast for the future?

Major General Sergei SIMONENKO: From my point of view, Belarusian-Turkish cooperation in the field of defense is at the beginning of its development. I believe, that in the future we could take certain steps towards building up our contacts and strengthening, among other things, military-technical cooperation between the defense establishments of our states.

Without limiting ourselves to mutual participation in the "MILEX" and "IDEF" armaments exhibitions, we could exchange experience in organizing the solution to problems of technical support for the armed forces. We are also interested in how the technical support system of the Turkish Armed Forces functions, how decisions are made on the technical re-equipment (reengineering) of combat units, how the repairing of armaments, military, and special purpose equipment that out of order due to combat damage and technical reasons, and many other issues is organized.

We could exchange experience in organizing the safe storage of armaments, military and special purpose equipment, missiles, and ammunition, organizing its repair, using modern diagnostic and production equipment. I believe, that such cooperation would be mutually beneficial for our states.

Defence Turkey: What can Belarus do for Turkey and what could Turkey do for Belarus in the defense sphere? Do you think that Turkish companies are sufficiently encouraged to participate in tenders in Belarus?

Major General Sergei SIMONENKO: The Republic of Belarus is always open to constructive dialogue and development of cooperation with other states in areas of mutual interest. At the same time, in the process of working with our partners, we always adhere to the most important principles: ensuring publicity, transparency, fair competition and an impartial attitude towards potential suppliers of goods and services.

Military goods of foreign origin are allowed to participate in public procurement procedures on equal terms with goods of domestic origin. In this regard, we do not exclude the possibility of considering proposals, including from the Turkish side, that would meet our requirements and that would be mutually beneficial for both states.

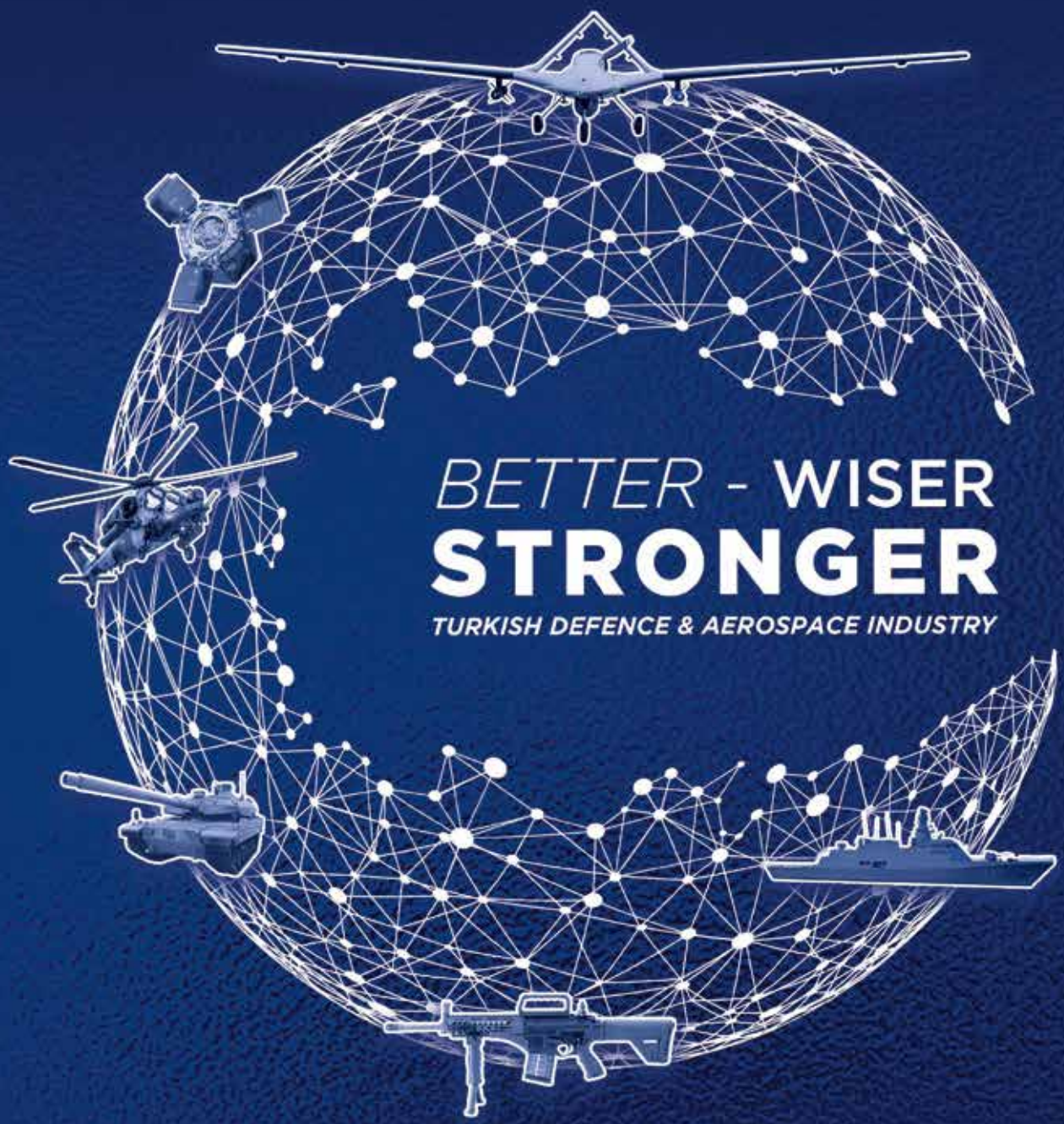
Defence Turkey: What can you share about the participation of the Government and military-industry sector of the Republic of Belarus in the "IDEF-2021" exhibition, which will be held in August 2021?

Major General Sergei SIMONENKO: Of course, forums of this scale are very important in the development of bilateral relations between states in the field of military-technical cooperation. Forums allow us to look for new partners, exchange experience on key issues in the development and production of armaments. We accepted the invitation, and we are honored to take part in the "IDEF-2021" exhibition.

The final format of our participation is still being determined, but the delegation of the Belarusian side from the Armament Headquarters of the Armed Forces will include acting officials responsible for the development of armaments, military and special purpose equipment as well as issues regarding procurement.

Defence Turkey: Do you want to add anything else as a message for our readers?

Major General Sergei SIMONENKO: First of all, I would like to thank you for your interest in developing friendly bilateral relations in the area of ensuring the defense capability of our states. We are always ready to openly cooperate on mutually beneficial terms in the field of improving armaments. I would like to wish your media outlet further creative success and best wishes



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10th SSI

Polish Minister of National Defense Mariusz BŁASZCZAK:

"We're speaking of a sum of approximately US$140 billion, allocated to the procurement of new armament and equipment for those who protect our security."

Poland will purchase 4 BAYRAKTAR TB2 Unmanned Combat Air Vehicle (UCAV) Systems (each contains 6 air vehicles and Ground Control Station as well as other related ground segment equipment) from Baykar Defence of Turkey under a contract inked on May 24, 2021, in Ankara, Turkey. Poland`s purchase of Turkish UCAVs marks the first time a NATO and/or European Union member state acquired drones from Turkey. During a state visit to Ankara, the contract was signed by Poland`s President Andrzej DUDA and Polish Minister of National Defense (MoND) Mariusz BŁASZCZAK. Within the scope of this official visit, Defence Turkey Magazine created an opportunity to have an exclusive interview with Polish MoND Mr. Mariusz BŁASZCZAK to get firsthand information on the Polish MoND, ongoing programs, and Poland`s approach to Turkey in terms of defense industrial cooperation.

Defence Turkey: Dear Minister, first of all thank you for this interview. What can you tell us about the Polish defense procurement process? Does Poland undertake defense procurement through a centralized defense organization within the country's Ministry of National Defense, or a separate government organization as in Turkey, or is the defense procurement administrated by a single agency like Defense Equipment & Support (DE&S) of the UK?

Minister Mariusz BŁASZCZAK: Currently, we are in the process of establishing an Armament Agency, which will be the primary institution responsible for the procurement of military equipment and the only decision-making center. It will be created as a result of a merger of several already existing institutions. The Armament Agency will make the procurement process in Poland much easier and faster.

Defence Turkey: What can you tell us about Poland's 2021 defense budget? Considering the fact that as a NATO member Hungary has pledged to allocate 2% of its GDP to fund defense spending, do you see Poland's defense spending increasing sharply in the coming years?

Mariusz BŁASZCZAK: Poland has been a NATO member since 1999 and has been steadily increasing its role on the eastern flank of the North Atlantic Alliance. Currently, we are one of the leaders of NATO in terms of defense spending. With increased roles come increased responsibilities, and we have reached the threshold of 2% GDP defense expenditure already in 2018. In 2020 defense spending reached 2.37% GDP, and we are on a path towards spending 2.5% GDP by 2030.

Defence Turkey: What can you tell us about the national defense policy of Poland? What is the biggest threat to Poland and the number one security risk facing the country?

Mariusz BŁASZCZAK: We live in an unpredictable world and must be ready to address various challenges. Two years ago, nobody thought we would have to engage in a fight against an invisible enemy to support our own population in its struggle against the COVID-19 outbreak – but we passed this exam well.

My policy is based on three pillars – efficient modernization, increasing the number of Polish soldiers, and deepen relations with NATO allies.

As far as our defense policy is concerned - we are actively engaging our Allies and partners in bilateral and multilateral formats to ensure we are prepared for the current and future eventualities. We are strong in alliances because we give to others as much (if not more) as we get. Our military is well versed in military and peacekeeping operations, and we send our troops to various parts of the world to both share our own and gain new experience – all with an expectation to be better prepared to cooperate with soldiers from other countries should the need arise.

Defence Turkey: What projects do you have on the modernization of military equipment? Can you list Poland's most important procurement programs and the envisaged time frame of realization?

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Poland Minister of Defense Marius BŁASZCZAK and accompanying delegation visited the Poland troops at Incirlik Base

Mariusz BŁASZCZAK: We hope that in the long-term, our region will remain peaceful. Nevertheless, the analysis of changes in our security environment forces us to increase our efforts to speed up with the modernization process. We need to modernize all types of armed forces, and we do this, gradually but consequently. The new plan envisages modernization expenditure that would match the expectations of the Polish soldiers. We're speaking of a sum of approximately 520 billion zł (approx. US$140 billion), allocated to the procurement of new armament and equipment for those who protect our security.

Defence Turkey: With an official farewell ceremony held at the airport in Gdynia-Babie Doły on April 20, 2021, soldiers of the Polish Military Contingent to Turkey were sent to Turkey. The soldiers of the Polish Armed Forces will support NATO's mission in Turkey. Can you elaborate on the details and mission period of the Polish Military Contingent to Turkey?

Mariusz BŁASZCZAK: Poland joined NATO's Tailored Assurance Measures mission in Turkey in April. Polish naval aviators have been patrolling the eastern part of the Mediterranean for several months and provide reconnaissance to Allies. This is the first and a very important mission of the Polish Armed Forces in Turkey, during which the main mission of Polish soldiers is to monitor the seas and to cooperate with NATO's standing naval groups and NATO's Maritime Command (MARCOM) in Northwood, UK.

Defence Turkey: What can you tell us about the agenda of your meetings in Turkey? What are the targets of your official visit to Turkey?

Mariusz BŁASZCZAK: During the official visit, I have met with the Turkish Minister of National Defense (MoND), and together with the Polish President Andrzej DUDA, we participated in bilateral talks. We have also visited the newly established Polish military contingent stationing in the Incirlik Air Base. The main goal of the visit, besides the official signing of the UAV's contract, was to establish a dialogue on defense and to find ways to even further enhance our mutual cooperation.

Defence Turkey: How do you evaluate the current state of Poland-Turkey cooperation in the defense field? Is Poland interested in bolstering defense industry cooperation with Turkey? What are the biggest challenges on the way to full and open cooperation between the two countries? What do you forecast for the future?

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Mariusz BLASZCZAK - Polish MoND & Hulusi AKAR Turkish MoND met together at the Minister of Defense Heaquarter on 25th May

Polish Minister of National Defence (MoND) Mariusz BŁASZCZAK briefed on BAYRAKTAR TB2 UCAV in Incirlik Air Base

Mariusz BŁASZCZAK: I am very hopeful our cooperation will flourish, and we will continue finding new and beneficial ways of supporting each other's military programs. Let's remember we are cooperating on a daily basis already in the NATO format, and this cooperation brings us closer to understanding our needs and mutual benefits of direct cooperation. Back in 2017, we have signed – and still stand by - the Declaration of Intent, defining the areas for further cooperation in the field of defense between Poland and Turkey.

Defence Turkey: What can you tell us about Poland's approach to Turkey in terms of defense industrial cooperation? Does the Polish MoND have a set target for activities with Turkey?

Mariusz BŁASZCZAK: We have very positive relations with Turkish defense cooperation, and we would like to build on that in the future. We are comparing similar products across the board and finding the best solution to our current and future needs. Whenever the Turkish industry is willing to offer a product to Poland and support the expansion of our own potential – it will definitely be taken under serious consideration. We also encourage our Turkish counterparts to look around in our domestic industry and see opportunities for investments and cooperation.

Defence Turkey: You recently shared a photo of BAYRAKTAR TB2 UCAVs on your personal Twitter account and wrote, "Good news is coming soon ... stay tuned." Later, on May 22, the Polish Ministry of Defense announced that Poland would purchase 24 BAYRAKTAR TB2 UCAVs from Turkey. What led Polish defense procurement decision-makers to select a Turkish company in defense requirements?

Mariusz BŁASZCZAK: We have just signed the document which allows for the procurement of the Turkish BAYRAKTAR TB2 UAV System by Poland. We will buy a total of 24 UAVs with all the equipment necessary for operations. The drones will be armed with GPS and laser-guided MAM-L and MAM-C smart munitions. When looking for equipment, we take numerous factors under consideration, and in this case, the product seemed ideal for our needs. I trust this procurement will bring some of the know-how to Poland, and we will be able to expand the cooperation to benefit the Polish economy as well. Polish companies also have expertise in the drone industry.

Defence Turkey: Do you believe that the existing partnership and cooperation in the field of defense between Turkey and Poland can be extended (opened-up) to other countries?

Mariusz BŁASZCZAK: We welcome all types of cooperation that expand on the potential of all involved parties. Should any program allow for the transfer of technologies, mutual-cooperation and equal benefits to all – I will always be in favor of that solution. There are many fields in which Poland and Turkey can cooperate and our daily cooperation within NATO and our bilateral agreements prove this point.

Defence Turkey: Dear Minister, thank you for sparing your valuable time for our readers

Mariusz BŁASZCZAK and Haluk BAYRAKTAR - CEO of Baykar signed a contract to procurement total 24 UAVs from Turkey with the witness of Turkish & Poland Presidents on 24th May

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Serdar GÖRGÜÇ, "In 2020, We Recorded 2.9 Billion TL in Revenues and 20% Growth with Exports of US$307 Million."

Defence Turkey talks to Serdar GÖRGÜÇ, Otokar General Manager, about the current footprint of the company in the Turkish Defense Industry, current technology, manufacturing capabilities and facilities and Otokar's international presence and market position in the field of military vehicles/land systems, in addition to other products.

Defence Turkey: As Turkey's first private Defense Industry company and the leading tactical wheeled vehicle manufacturer of the Turkish Defense Industry, Otokar celebrates its 58th anniversary in 2021. Can we start our interview with your comments on Otokar's current footprint in the Turkish Defense Industry today?

Serdar GÖRGÜÇ: Through our 58-year history, we brought to life numerous successful projects with our responsibility to our users and our country. Otokar is Turkey's pioneer and most experienced land systems manufacturer. Our combat proven know-how in land systems and related R&D, engineering, and testing capabilities as well as our wide product range puts us at the forefront of the global defense industry. Otokar is continuously expanding its user portfolio and serving a wider range of users across the world every year, due to its well appreciated user-oriented approach. Otokar is a preferred vendor to both NATO and the United Nations. Currently, around 33,000 Otokar military vehicles are actively used by armed forced and security forces in more than 35 countries, including Turkey. We are really proud of the point Otokar has reached.

Defence Turkey: Otokar operates in commercial/civil and military fields, which is a strategy adopted by many Defense Industry companies across the world. Otokar also adopted this strategy to achieve sustainable growth. Can you elaborate on the current balance of Otokar's activities between the civil/commercial side and the defense industry and breakdown the domestic/international side as well?

Serdar GÖRGÜÇ: As you mentioned, operating in two different areas is a specially chosen strategy for Otokar to achieve sustainable growth. Defense industry projects and orders sometimes take many years and have demonstrated a lot of differences in demand over years. The commercial vehicle field is more organized, but it is a field that is affected more quickly by economic fluctuations, it is labor-intensive, and its sales volume is lower compared to the general automotive field. These two different sectors balance each other and ensure the healthy and sustainable growth of Otokar. Although the rates may vary on a yearly basis depending on the projects, we balance the share of commercial vehicles and defense industry products in our turnover by half.

Export markets are particularly important for Otokar. Especially in land systems, we aim to reach a wider geography in exports, seize expansion and growth opportunities through technology transfers and joint production with local partners. In 2020, Otokar exports amounted to US$307 Million, accounting for 75% of our annual revenues. Throughout the year, we focused on delivering existing orders and we also signed new deals. In the first quarter of 2021, Otokar's revenue increased by 91% compared to same period of last year and our total export sales accounted for 57% of the total turnover.

Defence Turkey: Could you elaborate on Otokar's broad portfolio of business? What are the capability areas that Otokar boasts today? What can you tell us about the main technical advantages that make Otokar's military vehicles different from other similar products on the market?

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ARMA 8X8

COBRA-II assembly line

Otokar EMC Chamber

COBRA-I is seen here at Cylimate Chamber with dynometer

Serdar GÖRGÜÇ: Otokar designs and manufactures a wide range of defense industry products including 4x4, 6x6, 8x8 tactical wheeled armored vehicles and tracked armored vehicles as well as turret systems. Having a broad product range in land systems, Otokar also stands apart with its expertise in the design, development, and system integration of all kinds of vehicles and platforms. Being a preferred vendor to both NATO and the United Nations, Otokar is continuously expanding its customer portfolio and serving wider range of users over the world every year. This is mainly due to our well appreciated user-oriented approach. We analyze the different needs and expectations of our users for land systems, simulate these requirements in house and develop solutions that meet these requirements in the fastest manner thanks to our excellence in R&D, engineering, and testing.

Defence Turkey: As a global military land systems manufacturer Otokar is well known for its ability to provide innovative, effective, and tailor-made/customized solutions. Can you elaborate on Otokar's current technology, manufacturing capabilities and facilities?

Serdar GÖRGÜÇ: Our investments, our engineering capabilities, and the flexibility to produce according to user requirements have made us a preferred global land systems manufacturer over the years.

With numerous firsts to its name since its inception, Otokar carries out R&D activities at world standards. In the last decade we allocated 8% of our revenue for our R&D and testing activities. We continue to introduce innovative solutions in land systems by considering the current and future requirements of modern armies and security forces. Otokar R&D capabilities include CAD software for product design, simulation, and analysis, prototyping workshops, and a unique Test Center which houses Turkey's highest capacity hydraulic road simulator and a Climatic Test Chamber equipped with a 1,500hp Dynamometer, which is the one and only of its kind in Turkey and amongst a handful in Europe. The Test Center is also home to Turkey's largest and the world's best state-of-the art Electromagnetic Compatibility Test Center (EMC/EMI), which serves as an accredited independent EMI/EMC test center for all R&D activities of domestic and foreign automotive and defense industries.

Otokar Test Center activities support design activities by simulating real life conditions and generating invaluable feedback based on data. That is how we can meet various user expectations under various ambient conditions and are able to have a worldwide competitive edge over our competitors.

Defence Turkey: What can you tell us about your solution partners (local and international) in the field of military vehicles and in which areas do you cooperate with them?

Serdar GÖRGÜÇ: Otokar is a global company with 4 different subsidiaries in different locations. The company is in cooperation with many business partners all over the world. In 2020, Otokar worked with 981 suppliers, including 1,252 local companies, for direct and indirect procurements. We usually select our solution partners based on performance and on a cost basis, however, sometimes user requirements dictate this selection.


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Defence Turkey: What kind of new products do you see a demand for in the coming years in the military vehicles sector? What is on the horizon for Otokar, what can the industry expect to see as far as new products/ technologies and services?

Serdar GÖRGÜÇ: With the changing battlefield conditions and user expectations, armies now want to benefit from the operational advantages and logistics efficiency of technology at the highest level. Therefore, the expectations of new generation vehicles and solutions are increasing in modern armies. There is a desire for the use of technological solutions that will increase survivability, efficiency, and performance. In line with the expectations one of the areas that Otokar focused on is alternative fuel technologies. Otokar added a new electric military vehicle AKREP IIe to its product range in 2019.

Defence Turkey: How much time, effort and money does Otokar set aside on R&D annually?

Serdar GÖRGÜÇ: Otokar aims to develop new equipment and applications to meet the requirements of the future and has allocated 8% of its revenues for research and development (R&D) activities over the last 10 years, bringing R&D spending to 1.3 billion TL during that timeframe.

We analyze the different needs and expectations of our users for land systems and develop solutions that meet these requirements in the fastest manner due to our excellent engineering and superior R&D capabilities. We endeavor to continuously improve, and we will continue our investments in this context.

Ghana has officially received first Otokar Cobra-II 4x4 Armored Vehicles

Defence Turkey: Can we get an overview of 2020 from Otokar's point of view, and could you elaborate on your targets for 2021?

Serdar GÖRGÜÇ: 2020 was a difficult year that challenged the entire world. We deeply felt the impact of the pandemic on our fields of operation. From the early days of the pandemic, as a priority we took all necessary measures to protect the health of our employees, to ensure business continuity, and mitigate the impact and prevent infection. With safe production practices and several measures in place, our operations continued in the healthiest manner possible.

In 2020, we recorded 2.9 billion TL in revenues with 20% growth and exports amounted to US$307 Million, accounting for 75% of our annual revenues. Despite the cancellation of planned exhibitions and the imposed travel restrictions, we maintained our communication and relations with our target markets. We continued to consider the requirements of our clients to develop tailored solutions. This approach brought new achievements in defense industry exports last year and we received two new export orders. Production and deliveries of existing contracts continued throughout the year.

In 2021, we will continue to work without compromising our goals. While we are delivering our existing orders, we aim to take advantage of opportunities in technology transfer and joint production with local partners abroad, as well as following new export potential in various geographies.

Defence Turkey: According to the data provided by the Turkish Exporters Assembly (TIM), exports of the Turkish Defense and Aerospace Industry have secured a 47.7% increase during January 1 – April 30, 2021 and a 85.16% increase in April 2021 compared to the previous year. Could you provide a capsule summary of Otokar's major activities carried out during the first quarter of 2021 in terms of turnover and export figures?

Serdar GÖRGÜÇ: In the first quarter of 2021 Otokar's revenue rose to 877 million TL with a year-on-year increase of 91%. We increased our export revenues by 44% year-on-year to $69 million TL in the same period.

In the first quarter we continued to produce and deliver on existing contracts as planned. In February we participated in the IDEX 2021 defense exhibition in Abu Dhabi and introduced our electric armored vehicle, AKREP IIe for the first time to the international markets. We also displayed the new generation COBRA II MRAP for the first time.

AkrepII Fire Suppor Vehicle (90mm Turret)

© Otokar

Defence Turkey: What could you tell us about Otokar's international presence and market position in the field of military vehicles/ land systems, and the international programs/ tenders that you are currently undertaking? How many countries have your products been exported to? What key geographical markets are your next targets in?

Serdar GÖRGÜÇ: As a preferred vendor to both NATO and the United Nations (UN), Otokar consistently continues to strengthen its international presence. As a company that exports products with fully owned intellectual property rights, currently, around 33,000 Otokar made military vehicles are actively used by armed forced and security forces in Turkey as well as more than 35 friendly and ally countries. The performance of our vehicles that are serving worldwide are the most important reference for our potential customers.

We continue to carry out our promotional activities across different geographies evaluating new cooperation opportunities. Almost all countries, especially for big defense industry projects, now require the use of local opportunities and the development capabilities in the country. Only the manufacturers that adapt to such requirements are successful against international competition. Technology transfer for large procurement projects of this scale has become the most important competitive condition. Otokar now stands out in the defense industry, not only with its products but also with global knowhow, engineering, R&D and technology transfer capabilities. Otokar continues to strengthen its position in the regions where it operates by establishing affiliates and subsidiaries.

Defence Turkey: Could you inform us on the ongoing export activities and those expected to be contracted soon? In April 2020 Otokar announced that they secured an export contract from an undisclosed African country for the delivery of ARMA 8x8 Wheeled Armored Vehicles. Can you elaborate on the configuration/armament of these vehicles and their delivery schedule?

© Otokar

ARMA 8x8 Wheeled Armored Combat Vehicle is seen here during the test campaign in Kazakhstan

Serdar GÖRGÜÇ: Otokar armored vehicles continue to be favored by friendly and allied countries. In 2020, we received two different orders from two different African countries for various armored vehicles, spare parts, and training services. We plan to start deliveries in 2021 and to complete deliveries by the end of 2022. We are particularly proud that one of these orders includes the ARMA 8x8. Our ARMA 8x8 vehicle will begin to serve in missions on the continent of Africa for the first time.

Defence Turkey: Can you provide an update on the current status of the AKREP IIe and URAL Special Operation Vehicle Projects that were launched in 2019?

Serdar GÖRGÜÇ: The AKREP II Family will be an outstanding solution for modern Armies with its superior maneuverability and agility as well as the outstanding design allowing the integration of various types of armament, weapon stations and alternative power packs.

The electric powered armored vehicle AKREP IIe was introduced in 2019 as the first version of the AKREP II product range. AKREP IIe is well suited to meet the challenging requirements of armies across the world and to respond to tactical performance expectations, offering many benefits, especially in fuel efficiency, mobility, survivability, and integrated logistics support.

We are continuously working on the development process of the vehicle and the new versions of the AKREP II Family.

© Defence Turkey

URAL Special Operation Vehicle is here at IDEF'19

The new variant of the versatile modular URAL platform, the URAL Special Operations Vehicle (SOV), made its debut at IDEF '19. Designed for the needs of military units and other security forces engaged in special operations, the URAL Special Operations Vehicle delivers superior mobility as well as high ballistic, mine and side ballistic protection for its crew, thanks to the armored semi-body, base, and fire wall.

Defence Turkey: Is the COBRA 4x4 Wheeled Armored Vehicle still in production? How many COBRA vehicles have been produced and delivered so far? How many Armed and Security Forces around the globe COBRA?

Serdar GÖRGÜÇ: COBRA is one of a kind in the world in terms of its mobility, amphibious capability, protection, and modularity. Developed to respond to internal security forces' need for easy access in and out of the vehicle, COBRA stands out with its superior mobility and survivability.

The COBRA 4x4 armored vehicle is still in production. We have built over 4,000 COBRAs over years. Actively used in 15 countries across the world, COBRA features a modular platform that can be configured for different missions and it serves as one of the most preferred vehicles by UN forces for its exceptional features.

Defence Turkey: Unveiled in May 2013, the COBRA II 4x4 Wheeled Armored Vehicle has quickly gained user appreciation with its successful performance in Turkey, as well as in export markets. How many COBRA II vehicles have been produced so far and how many countries have inducted COBRA II into their services/inventories?

Serdar GÖRGÜÇ: COBRA II 4x4 Tactical Wheeled Armored Vehicles are in the inventory of 6 services in Turkey and 3 export countries. Otokar has delivered more than 600 COBRA II vehicles in different configurations including Armored Personnel Carrier, Armored Ambulance, Armored Patrol, Command and Control and Reconnaissance and Surveillance variants.

Defence Turkey: Otokar recently unveiled its new generation MRAP vehicle COBRA II MRAP. What kind of requirements/demands and technologies have led Otokar to introduce COBRA II-MRAP into the market? Can you elaborate on its technical features and superiorities that make COBRA II-MRAP different from other 4x4 MRAP vehicles on the market?

Serdar GÖRGÜÇ: COBRA II MRAP is a next generation Mine Resistant Ambush Protected Vehicle, which combines a high level of survivability and mobility in a modular package. The vehicle provides superior

protection for the crew against ballistic, mine and IED threats while maintaining high cross-country mobility with its independent suspension system. It is specifically designed to provide high reliability, ease of maintenance and quick removal/installation of power pack.

With its modular design, COBRA II MRAP provides high payload and spacious internal space for integration of weapons systems and mission equipment. The vehicle can be configured with alternative seating layouts for up to 11 personnel with 3 or 5 door configurations as per specific user requirements.

Defence Turkey: Can you provide an update the current status of the TULPAR Light Tank, which was tested by two different users. Do you expect any interest for the TULPAR Tracked Armored Vehicle from Turkish Armed and Security Forces? Do you have any plans to integrate an indigenous powerpack (when it becomes available) to TULPAR for testing purpose?

Serdar GÖRGÜÇ: Tests of TULPAR under the toughest climatic and terrain conditions were completed and the vehicle was qualified. Developed to meet the needs of different countries in global markets, TULPAR's performance in tests and feedback from potential users are quite satisfactory.

The need for such vehicles has been increasing in recent years. TULPAR is capable of responding to the needs of different countries both in terms of technical capability and cost. TULPAR is ready for mass production; we follow current needs around the world, including Turkey' needs.

Otokar displayed its new Mine Resistant Ambush Protected Vehicle "COBRA II MRAP" at IDEX 2021

Our engineering and production capabilities, and the flexibility to produce according to user requirements have always made us a preferred global land systems manufacturer. Since we have the intellectual property rights of our vehicles, we are ready to meet any requirements including the integration of indigenous powerpack.

Defence Turkey: Could you elaborate on the short and long-term targets of Otokar in the commercial and military vehicle sectors; and where do you envision Otokar will be 10 years from now?

Serdar GÖRGÜÇ: As a company that stands out with its products, engineering and production capabilities and experience, Otokar is always ready to serve Turkey, first and foremost. In terms of international markets, Otokar's targets include higher exports to a vast geography and seizing opportunities for technology transfer and production with international partners at their locations.

Defence Turkey: What can you tell us about Otokar's participation in the IDEF '21 Exhibition? What are you expecting from the exhibition?

Serdar GÖRGÜÇ: We have been participating in IDEF, one of the biggest defense exhibitions in our region, from the very beginning. As Turkey's leading land systems manufacturer, we have announced many firsts and innovations at IDEF. In this context, IDEF is a very important event for Otokar.

During IDEF this year, we plan to improve our cooperation with our current users while promoting our capabilities in land systems to potential users. As Turkey's leading land systems manufacturer, our goal is to continue our contribution to the country's exports with our products, R&D, and technology transfer capabilities in global markets.

Defence Turkey: Mr. GÖRGÜÇ, thank you for sparing time for our readers today

TULPAR Medium Tank

Turkish Defense Industry Capabilities in Underwater Warfare Technology

by İbrahim SÜNNETÇİ

During the last two decades Turkey has quietly developed an indigenous defense industry that is poised to be a significant player in international military procurement. Today, Turkey's domestic industry has reached a certain level of capability to provide state-of-the-art NATO standard defense systems within a large range consisting of both wheeled and tracked armored combat vehicles, naval (surface & underwater) and air platforms, high-tech defense electronics, software, weapon systems, ammunition and logistics required by the Turkish Armed Forces (TAF), the second-largest standing military in NATO.

Realizing almost ¼ of the turnover and 15% of the exports, the Defense Electronics sector is likely one of the strongest and fastest developing sectors of the Turkish Defense Industry. Thanks to the capabilities of domestic industry the TAF already has fielded advanced communications and information systems on par with the top technologies found in modern militaries. Among the top electronics technologies under development are land, air and naval-based command and control systems (combat management systems), network-enabled technologies and sensors. As with other modern militaries, Turkey views network-enabled command and control system capabilities as a significant force multiplier for all platforms and infrastructures in which it has invested over the last two decades. Indigenous tactical command and control systems in particular have been receiving substantial investment since the early 2000s.

Some successful designs such as GENESIS, GENESIS ADVENT and MUREN Combat Management Systems (CMSs) have been fielded during the last two decades. GENESIS and GENESIS ADVENT Combat Management Systems are designed for naval surface applications and MUREN CMS (based on GENESIS ADVENT) is designed for naval underwater applications. The 3,640-ton GABYA Class (ex-US FFG-7 Perry Class) Frigates of the Turkish Naval Forces (TNF) were modernized locally during May 2007 - August 2012 at Golcuk Naval Shipyard with the integration of the indigenously developed GENESIS (Ship Integrated Combat Management System) CMS, which has greatly enhanced their capabilities compared to the original design (with GENESIS GABYA Class that can track over 1,000 tactical surface and air targets simultaneously, while in the original configuration only 64 targets can be tracked simultaneously). Developed by the Turkish Navy Research Center Command (TNRC-C/ARMERKOM) and implemented by the Turkish company Havelsan, GENESIS is a fully integrated CMS suite that encompasses all ship functions, including navigation, communications, sensors, and weapons. Its open architecture allows greater interoperability and integration of upgrades to individual capabilities. It provides for modern sensor data fusion and automatic threat evaluation. GENESIS also permits integration of Link-16/22 tactical data links. The first two of four ADA Class Corvettes constructed under the MILGEM Project and commissioned during 27 September 2011 – 29 September 2019 were integrated with GENESIS while the last two platforms received the network-enabled version 'GENESIS ADVENT'. With its integration capability with a wide variety of sensors and weapons, the ship-borne GENESIS ADVENT CMS is a powerful and scalable C4I System that provides planning, tactical picture compilation, decision making and weapons control to meet current and emergent threats. With approximately 550 applications having different tasks within the CMS and around 13 million lines of software code, ADVENT CMS is one of the most comprehensive combat systems in the world. The GENESIS Combat Management System on-board the GABYA Class Frigates, has 3 million lines of code, while the system on-board the TCG Bayraktar (L-402) LST ship has 3.9 million lines of code.

Turkish Defense Electronics Sector companies have also been active in the field of underwater warfare since the early 2010s. In this context, while TUBITAK BILGEM (Informatics and Information Security Research Center) providing the indigenously developed MUREN Integrated Underwater Combat Management System for the AY and PREVEZE Class Submarines in TNF service, Havelsan delivers both Integrated Underwater Combat Management System (based on ISUS-90/72 but Turkey unique solution. Configuration management of all source codes for the Integrated Underwater Combat Management System takes place under the leadership of Havelsan), which also contains SEDA Combat Management System software developed by Havelsan,

and the Submarine Information Distribution System (utilizing real time embedded software technology the SMIDS/DBDS is integrated with 105 different units on-board the submarines) for the Type 214TN REIS Class Submarines. Aselsan on the other hand delivers seven different subsystems including the submarine sonar system, ESM, SatCom and radar systems within the scope of the PREVEZE-MLU Project and STM is carrying out the Mid-Life Upgrade (MLU) of Pakistan Navy's Agosta 90B Class Submarines with the participation of other Turkish companies including Aselsan and Havelsan. In this article we will provide some details on MUREN-AY, MUREN-PREVEZE, PREVEZE-MLU Projects of the TNF and the Pakistan Navy's Agosta 90B MLU Program led by Prime Contractor STM under a contract awarded in 2016.

MUREN-AY Project

Under the contracts signed on June 2, 2016, between TUBITAK BILGEM and the TNF, the indigenous MUREN Integrated Underwater Combat Management System, which was developed by TUBITAK BILGEM for the AY Class (Type 209/1200) Submarines in TNF service, was integrated and put to service on the TCG Doğanay (S-351) and TCG Dolunay (S-352) Submarines under a two

MUREN CMS Operator Consoles developed by YALTES for AY Class Submarines

and half-year schedule. Under the contract, one Ground Station System (Land Based Test System, with hardware and software identical to those installed on submarines) was also delivered and activities under the contract were completed during the first quarter of 2019.

Within the scope of the Project conducted under the cooperation of the TNRC-C/ARMERKOM, Golcuk Naval Shipyard and TUBITAK (an institution which has adopted a mission to conduct R&D studies in order to fulfil the existing and near future security and defense related requirements of the Defense Industry), modern heavy weight torpedo (HWT) discharging capability, sensor data such as sonar, periscope and electronic support and indigenous target motion analysis, track management and indigenous weapon control unit capabilities were added to two of the four AY Class Submarines in the TNF inventory. The GENESIS ADVENT based MUREN-AY CMS has been actively utilized on the TCG Doğanay (S-351) and the TCG Dolunay (S-352) Submarines since late 2018. According to the information I received, 8 HWTs were launched in 2018 as part of the test campaign. As Mk48 Mod 6AT and AKYA HWTs were not identified within the scope of this project, only DM2A4 SeeHecht modern HWT could be launched by the MUREN CMS.

With the MUREN CMS, not only modern HWT launching capability but also a critical capability called Target Motion Analysis - TMA bearing vital importance for the submarines, was acquired. Due to the lack of space in the submarines' Combat Information Center (CIC) only two operator consoles, which could replace each other and feature a water-cooling system, have

One of two modernized AY Class Submarines approaches Golcuk Naval Base while the SERO 250 attack and surveillance periscopes and ESM antenna mast deployed

been installed in the modernized AY Class Submarines for the MUREN CMS. In case there is a breakdown in one of these consoles, the software could be transferred to the other. These consoles are manufactured by YALTES. In this Project, for the AY Class Submarines, YALTES designed and delivered a special console that needed to fit into a very limited area, and upon the success it achieved in the MUREN-AY Project, the company secured a quite large work share (covering five different units) in the MUREN-PREVEZE Project. The MUREN-AY CMS can manage 4 different HWTs engagements simultaneously.

STM previously carried out the modernization of two AY Class Submarines in service of the TNF. Under a contract awarded on March 30, 2011, the system and equipment modernization of two AY Class (Type 209/1200) Diesel-Electric Submarines (TCG Doğanay [S-351] and TCG Dolunay [S-352]) in the service of the TNF were performed by Prime Contractor STM in cooperation with Golcuk Naval Shipyard. Modernization efforts, launched in November 2012 at Golcuk Naval Shipyard, covered replacement of the existing DR2000U ESM with ARES-2SC Radar ESM, surveillance (BS-19) and attack periscopes (ASC-18) with SERO-250S and SERO-250A periscope sets and the aging INS with Raytheon's Inertial Navigation System. Following the completion of their modernization efforts, TCG Dolunay was re-delivered to the TNF on April 9, 2014, and TCG Doğanay on April 22, 2015. The periscope modernization of the AY Class Submarine is the first project that Hensoldt Optronics has had with STM.

A CGI of MUREN-PREVEZE CMS consoles

Meanwhile under a US$1.78 million contract awarded in 2016, Aselsan developed a national intercept sonar within a 9-month schedule named ASIST (Aselsan Intercept Sonar System) for three of four AY Class Submarines and carried out acceptance tests in June 2017. Following the integration efforts, the Harbor Acceptance Tests (HAT) and Sea Acceptance Tests (SAT) of the first ASIST sonar on-board the TCG Batiray (S-349) submarine was completed in December 2017. Today, three of the four AY Class Submarines are operating with Aselsan's ASIST intercept sonar. The Submarine Intercept Passive Sonar (IPS) manufactured by Meteksan Defence was installed to one of the four AY Class submarines in the TNF's service. The Intercept Sonar System is located at the back part of the sail in AY Class Submarines, and in PREVEZE and GÜR Class Submarines it is located inside the hatch bulging out at the nose section.

A view from an AY Class Submarine CIC fitted with vintage Signaal/Thales' WM-8/42 Torpedo Fire Control System

MUREN CMS PREVEZE Class Implementation Project

Two separate modernization projects are currently carried out in parallel for TNF's PREVEZE Class (Type 209/1400) Submarines: MUREN CMS PREVEZE Class Implementation Project and Mid-Life Upgrade (MLU) Project. Launched first under a contract awarded on August 1, 2017, the MUREN CMS PREVEZE Class Implementation Project is being carried out in cooperation with the TNRC-C/ARMERKOM, Golcuk Naval Shipyard and TUBITAK BILGEM. The Sea Acceptance Tests (SAT) of the first submarine (TCG Preveze) equipped with MUREN CMS was supposed to be completed in June 2021, but this schedule was later extended by at least 6 months. According to current information TCG Preveze's SAT will be completed by the end of 2021 or early 2022. According to contract, activities under the project should be completed in 72 months following the contract effectivity (To).

Within the scope of the MUREN CMS PREVEZE Class Implementation Project, the ISUS-83/2 Combat Management Systems (CMS) on-board the submarines will be replaced with GENESIS ADVENT based MUREN-PREVEZE CMS and 20 different sensors and navigation systems on board the submarines will be integrated with the MUREN-PREVEZE CMS. With the project, the PREVEZE Class Submarines will also gain the capability to use/deploy DM2A4 SeeHecht, Mk48 Mod 6AT/7AT and AKYA National Heavyweight Torpedoes. On March 8, 2021, a contract was signed between TUBITAK BILGEM and the Istanbul Naval Supply Group Command of the TNF for the integration of AKYA National HWT into MUREN-PREVEZE CMS. When it is completed and becomes operational, Roketsan's ATMACA Block II anwti-ship cruise missile (ASCM) is also expected to be integrated on PREVEZE Class Submarines. Under the AKYA National Heavyweight Torpedo (HWT) Project, the first guided firing test (with an REXTORP Exercise Torpedo that does not carry a live warhead) against a mock target was successfully carried out on January 20, 2021, from a GUR Class (Type 209/1400 Mod) Submarine at the Submarine Training Field of the TNF located in the Gulf of Izmit in the Marmara Sea. The AKYA National HWT is planned to be inducted into TNF service in 2021.

A view from the Combat Information Center (CIC) of one of the modernized AY Class Submarine that fitted with Hensoldt's SERO-250A/S Periscopes and YALTES OpCons

The contract covers the deliveries of 1 Ground Station System (Land Based Test System, established at the MUREN Laboratory and which became operational in January 2021) and 4 Submarine Systems. Within the scope of the project, the MUREN Laboratory was officially opened within TNRC-C/ARMERKOM premises by the TUBITAK Informatics and Information Security Research Center (BILGEM) in early August 2020. The Laboratory also includes the Land Based Test System (with hardware and software identical to those to be installed on submarines) of the MUREN-PREVEZE Integrated Submarine Combat Management System. Within the scope of the MUREN-PREVEZE Project, all tests before the integration of systems into submarines are carried out in this Laboratory. As the subcontractor of TUBITAK BILGEM, YALTES develops and produces the operator consoles (with a dual cooling system. In the event of water-cooling failure in the submarine, the consoles would be able to cool with air and continue their duty), electronic cabinets, combat data/video networks, and Local Firing Panels for PREVEZE Class Submarines. The existing equipment in the CIC (Combat Information Center) of PREVEZE Class Submarines will be emptied completely, and the ISUS-83/2 CMS will be replaced with the MUREN CMS.

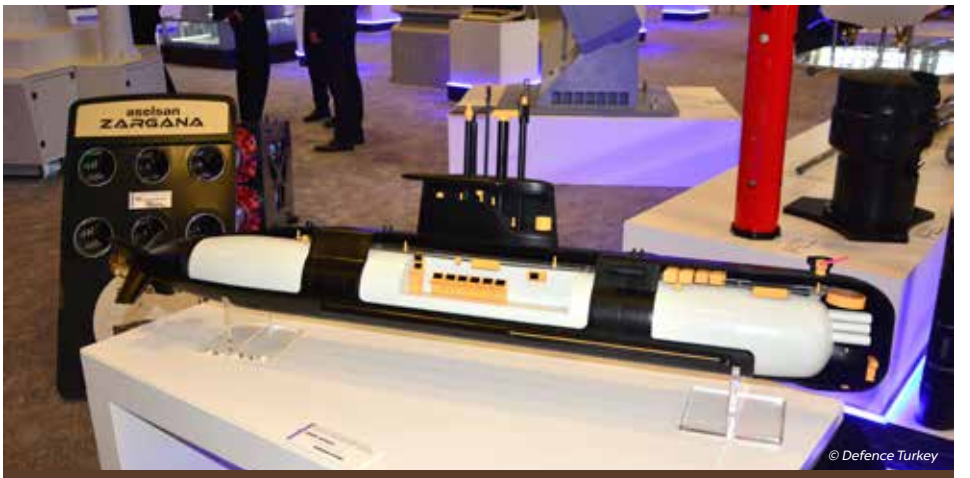
On January 21, 2021, TUBITAK President Prof. Dr. Hasan MANDAL confirmed that the MUREN-PREVEZE CMS had become operational. MANDAL said, "We received great news today. The MUREN-PREVEZE CMS is starting to be used by the Turkish Naval Forces Command. In other words, it passed through the testing phase and is starting to be used in a real environment." MUREN-PREVEZE had become operational first at the MUREN Laboratory rather than on the TCG Preveze Submarine. In January 2021 acceptance tests of the MUREN-PREVEZE CMS in the Land Based Test System (a kind of System Integration Laboratory established in the MUREN Laboratory) was completed successfully and the system became operational.

A view from inside of MUREN Laboratory

MLU of PREVEZE Class Diesel-Electric Submarines

On February 8, 2019, the Presidency of Defense Industries (SSB) and a joint venture formed by STM-Aselsan-Havelsan-ASFAT (also including KBST as a subcontractor) signed a contract on the Mid-Life Upgrade (MLU) of PREVEZE Class (Type 209/1400) Diesel-Electric Submarines that was commissioned between 1984-1999. According to the contract, which became effective on July 17, 2019, following the completion of their MLU modernization efforts, PREVEZE Class Submarines were supposed to be re-delivered to the TNF during 2023-2027. But this scheduled was revised. According to Alper KOSE, Head of the SSB Naval Platforms Department, under the PREVEZE MLU Project the first modernized submarine will be delivered in 2024, the second one in 2025, the third in 2027 and the last in 2028.

Within the scope of the comprehensive Mid-Life Upgrade the PREVEZE Class Submarines (S-353 Preveze, S-354 Sakarya, S-355 18 Mart and S-356 Anafartalar) will be equipped with new generation Sonar, Surveillance and Attack Periscopes, Satellite Communication (SatCom) System, Integrated Communication System, Electronic Support System (ESM), Marine Radar, WAIS System and Harpoon AShM Fire Control System. According to the Project schedule, TCG Sakarya – the first submarine, will be delivered in 2024 after the SAT (Sea Acceptance Tests). Then, the modernization of the three remaining submarines will be completed by the end of 2028. TCG Preveze is the first submarine being upgraded with the MUREN-PREVEZE CMS and TCG Sakarya will be the first submarine to receive both MLU and MUREN-PREVEZE CMS upgrades at the same time. TCG Preveze, the first submarine fitted with MUREN-PREVEZE CMS, will be the last submarine to receive MLU. The activities regarding the Preliminary Design Phase of the PREVEZE Class Submarine MLU Project were completed in 2020.



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Foreground the PREVEZE MLU model depicting modernized units (in yellow color) and background ASELSAN ZARGANA Torpedo Decoy Launcher

The acoustic detection sensors and low-noise front-end electronic units of the Intercept Passive Sonar and the Intercept Data Ranging Sonar that will be used aboard PREVEZE and GÜR Class Submarines are being designed and produced indigenously by Meteksan Defence. Meteksan Defence's MSH-01 hydrophones and their equivalents are retained as spare parts for the AY and PREVEZE Class Submarines' Cylindrical Hydrophone Arrays, Passive Ranging Sonars and Own Noise Measuring Systems.

Under the MUREN CMS PREVEZE Class Implementation Project, on 31 July 2018 a contract entitled "Sonar Subsystem Procurement for Integration into the MUREN CMS aboard PREVEZE Class


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Within the scope of MUREN-PREVEZE Modernization existing ISU-83/2 CMS is being replaced with indigenous MUREN-PREVEZE CMS

Submarines" was signed between TUBITAK BILGEM and Meteksan Defence for the local development and manufacture of electronic and signal processing hardware and software of the sonar and underwater acoustic systems, which constitutes the important part of MUREN CMS to be integrated on PREVEZE Class Submarines. The MUREN Submarine CMS for the GÜR Class Submarines will be designed and will be integrated on the platforms under a separate contract during the second half of the 2020s. In addition, Meteksan Defence has also indigenously developed the sensor elements of the Flank Array Sonars of the existing submarines (PREVEZE and GUR Class), and these sensors have reached the Sea Acceptance Test (SAT) phase. According to Meteksan Defence, the 1st Stage FATs were conducted in March 2020. Once the qualification phase has been completed, they will become available for use as spare parts.

Within the scope of the PREVEZE Class Submarine Mid-Life Upgrade (MLU) Program, acoustic sensors, which are the basic and most important sensor group of a submarine, will be replaced with more modern, more effective, and indigenous sensors. In this context, by changing wet-end units of the Cylindrical Hydrophone Array, Passive Ranging Sonar, Flank Array Sonar (FAS), Intercept Sonar, Active Sonar and Own Noise Measurement Systems, the acoustic capabilities of PREVEZE Class submarines will be improved. The Acoustic Sensors of PREVEZE Class Submarines will be provided by Aselsan and Meteksan Defence. Aselsan will provide seven different subsystems under the PREVEZE MLU Project; Sonar (all wet end parts of the submarine sonar system), SatCom (indigenous design and will have 60cm antenna), Integrated Communication System (for both internal and external communications), ESM (Aselsan ARES-2SC), Radar System, WAIS System and Harpoon Fire Control System (to be integrated with the MUREN-PREVEZE CMS).

On August 5, 2019, HENSOLDT Optronics GmbH announced that it had received contract valued at around €40 Million from Savunma Teknolojileri Mühendislik (STM) under the PREVEZE Class Submarine MLU Project to upgrade existing search and attack periscopes on-board four PREVEZE Class Submarines. Under this contract, HENSOLDT Optronics will provide a total of four SERO 420 Attack Periscopes and four SERO 430 Search Periscopes to replace L3 KEO (formerly known as Kollmorgen)'s Model 76 Search and Attack Periscopes ordered in 1987 and integrated on the submarines during early 1990s. The MLU is designed to extend the operational life of the PREVEZE Class Submarines until the 2040s, when they are planned to be replaced by MILDENs (National Submarines).

Meanwhile, the steal cutting and first welding ceremony for the 3,000 Ton Submarine Floating Dock was held on August 18, 2020, at Hicri Ercili Shipyard in Yalova. The Submarine Floating Dock, with a lifting capacity of 3,000 tons, will have an overall length of 105m, width of 25.10m and draught of 15.9m. Being constructed with steel under a contract awarded by ASFAT to Yütek Gemi İnşa in 2020, the new 3,000 Ton Submarine Floating Dock will be utilized both in the PREVEZE MLU and MILDEN Projects. According to the project schedule the 3,000 Ton Submarine Floating Dock will be delivered to ASFAT in 18 months following the contract effectivity (To+18 months).

Pakistan Navy Agosta 90B Khalid Class Submarines MLU Program

On June 22, 2016, STM signed a contract with the Pakistani Ministry of Defence Production, surpassing French Shipyard DCNS (now Naval Group), the submarine manufacturer, in an international tender opened for the Mid-Life Upgrade (MLU) of Khalid Class Submarines 'Agosta 90B'. The original contract covered only one submarine and includes an option for the MLU of the other two. Since then, three contract amendments were signed in June 2017, February 27, 2018, and March 2019 respectively for the provision of an additional two submarines and important subsystems from Turkish companies. The total value of the Program is estimated at US$350 Million.

The MLU of the first submarine, PNS/M HAMZA (S-139), was started in 2018 and it was launched (transferred from floating dock to the sea) in December 2019, following the completion of its outfitting. The Prime Contractor STM aimed to deliver the first submarine of the project to the Pakistan Navy by the end of December 2020, after the completion of Harbor Acceptance Tests (HAT) and the Sea Trials (Sea Acceptance Tests/SATs, including diving tests) that started in March 2020 in the Arabian Sea. The PNS/M KHALID, the second submarine being upgraded under the MLU Program, is planned to be delivered in December 2021. According to STM, the Agosta 90B MLU Program is progressing very successfully despite the restrictions imposed by France, the producer of the submarines. Regarding this issue, on February 25, 2020, the then General Manager of STM Murat IKINCI, said "Despite their restrictions, with the support of our national industry, we successfully continue the construction and modernization work by replacing many products with Turkish made products."

The scope of the modernization consists of the replacement of the Fire Control System, Sonar Suite, Electronic Support Measures (ESM) System, Radar and Periscope System (Under a contract awarded by STM in

October 2016 Hensoldt is supplying OMS 200 Optronics Masts [Attack Periscope] and SERO 430 Search Periscopes) Navigation and Attack). As the Prime Contractor, STM provides integration design, preparation of relevant documents, integration activities, tests, and experiences as well as Integrated Logistics Support services. The project is being realized in Pakistan and all workmanship is provided by PN Dockyard. In this context STM will provide the Integrated Underwater Command Control System and Sonar Suite as well as Sonar Subsystems that work in integration with it, the Submarine Information Distribution System, Torpedo Fire Control System, Attack and Navigation Periscopes, ESM System, Navigation Radar, Static Converters, Steering Control System, Ship Self-Noise Measurement System, Submarine Rescue Buoy and Digital Bridge Information Console with 45 bar strength, and in addition to these systems the company also provides the Auxiliary Cooling Water System to cool the ESKKS, Torpedo Counter Measure System and Electronic Map Display and Information System. The Integrated Underwater Command Control Systems (which also contains Sonars, Torpedo Fire Control System, SEDA Combat Management System and Submarine Information Distribution System) are supplied by Havelsan (the company has already completed deliveries), the ESM (ARES-2SC/P, the antennas for the ESM and RWR/GPS are mounted on separate periscopes, the RWR/GPS Antenna and Signal Distribution Unit [SDU], for example are mounted on Hensoldt's OMS-200 Optronic Mast), the Torpedo Counter Measure System (ZARGANA TCMS, along with ZOKA Anti-Torpedo Acoustic Decoy Family comprising both stationary and self-propelled jammers and target emulator decoys) and the Navigation Radar System are supplied by Aselsan and the Auxiliary Cooling Water System by Bronswerk, Turkey. STM provides the Submarine Rescue Buoy, 45 bar resistant Digital Bridge Information Console, Electronic Map Display and Information System in addition to all materials for all structural/technical design, analysis, documentation and installation. We can express with pride that, in addition to Aselsan and Havelsan, there are also dozens of Turkish Defense Industry companies involved in this ecosystem considering the cables for installation, pipes, valves, flanges, panels, consumables, etc.

Within the scope of Pakistan Agosta 90B MLU Program HAVELSAN delivers Submarine Combat Management Systems (CMS)

The Agosta 90B submarines are 76 meters long and weigh around 2,050 tons. They have range of 10,000 nautical miles and can remain at sea continuously for 60 days. They are equipped with SUBTICS (Submarine Tactical Integrated Combat System) CMS and are capable of firing SM-39 Exocet missile and DM2A4 heavy weight torpedoes.

STM is also involved in the Pakistani Navy's Miniature Submarine Program. The first project prepared by STM in line with the needs of the Pakistan Naval Forces was submitted in 2017. Within this framework, efforts on the design of small-sized submarines capable of addressing a wider market are continuing within the scheduled plan ■

HAVELSAN delivered CMS operator consoles and SMIDS consoles for the TNFC's 4th REIS Class Submarine TCG AydınReis in July 2021

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Mr. Lorenzo MARIANI: *"As member of two partnerships producing Next Generation Future Combat Air Systems (Tempest / FCAS), MBDA will continue to mature capable, affordable, upgradeable, connected, and cooperative effectors for future air dominance."*

Turkey is a member of NATO and an important player in the Middle Eastern and Mediterranean basin. In our recent interview with MR. LORENZO MARIANI, MBDA Group Sales and Business Development Director and Managing Director of MBDA Italy, we discuss past, current and conceivable future strategic programs with Turkey.

MBDA is the only European defense group capable of designing and producing missiles and missile systems that correspond to the full range of current and future operational needs of the three-armed forces (land, sea, and air). It has an important presence in five European countries: France, Germany, Italy, United Kingdom and Spain and in the US as well. MBDA is jointly owned by Airbus (37.5%), BAE Systems (37.5%), and Leonardo (25%) and with more than 90 customers among the Armed Forces worldwide is among the world champions in design, development and production of missiles and missile systems. Overall, the Group offers 45 missile systems programs and countermeasures already operational and over 15 other projects under development.

Defence Turkey: Can you describe MBDA's current activities and provide some key facts about the company for our readers? What are MBDA's strong points and how does it differ from its competitors? Could you elaborate on the structure, responsibilities, and number of personnel working at MBDA?

Lorenzo MARIANI: MBDA today represents the only European defense industrial group conceived with an integrated managerial structure: a successful example of integration and cooperation at a European level, which over time has really given excellent results. It is remarkable that when MBDA was born, the volume of production was around €2 billion, today it has substantially doubled it with growth also in terms of employees. Furthermore, despite a very strong domestic base, over half of this turnover has come over the years from exports. MBDA's model is based on an integrated organization built beyond any nationality. Its "governing body" is in fact the Executive Committee with a CEO, today Eric BÉRANGER, and eight other figures organized by function not by the nationality of the

individuals. Furthermore, four of these figures also hold a statutory role for each single nation, for statutory tasks reserved to each nation, serving as the contact with domestic customers and all the statutory obligations of the civil codes that must be observed. Just to give a more recent number of employees, which were declared during the annual press conference, MBDA nowadays can rely on about 12,000 permanent employees. In 2020 it recruited about 1,100 people. This will continue in 2021 when the company is planning to recruit a further 1,200 people: this is further evidence that MBDA has been resilient and is in a growth pattern.

Defence Turkey: Can we get an assessment of 2020 from MBDA's perspective? Could you please summarize the 2020 MBDA highlights?

Lorenzo MARIANI: We did very well in 2020 despite the COVID pandemic. We were impacted, of course, especially in exports, in terms of order intake, but all in all the performances are quite remarkable: we achieved €3.6 billion in terms of revenues. In terms of order intake, we reached €3.3 billion, and we now have a backlog of €16.6 billion. Also, during this specific period, we could see how much solidarity exists inside our defense ecosystem to support each other and make sure that we deliver on our missions.

As far as orders are concerned and starting from our domestic markets, I can mention for the UK the upgrade of the Brimstone 3 and the production of Brimstone missiles. We also got, from the UK MOD, a production order for SPEAR mini-cruise missiles. Just to have a glance on France, we received a contract for the midlife refurbishment of Aster missiles and for the Future Tactical Air-to-Surface Missile (MAST-F) program as the main French Army air to ground arma¬ment for the Tiger combat helicopter. In Italy, we were contracted for the new generation anti-ship missile TESEO MK2/E, while in Germany for a high-energy laser demonstrator for the German Navy. I can also mention the participation in the Beyond-Line-Of-Sight initiative, which we are running among 5 nations and 13 partners. Export sales include, among the others, a naval package for Senegal and a contract signed for our Albatros NG, and a new naval surface-to-air defense system based on the CAMM-ER missiles for an undisclosed customer.

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Dual Mode Brimstone (DMB) Missile

© MBDA

METEOR Beyond Visual Range Air-to-Air Missile (BVRAAM)

Defence Turkey: The COVID-19 pandemic has caused huge global disruption on critical defense operations and programs. Can you elaborate on whether you experienced any delay or postponement in your annual activity plan/ schedule for 2020 due to the COVID-19 pandemic? How and to what extent has the COVID-19 pandemic impacted your business operations including production, manufacturing, and supply chain as well as your domestic and international programs?

Lorenzo MARIANI: We underwent some delay at the beginning of 2020, everybody was taken by surprise. Indeed, we recovered very quickly thanks to the capability of guaranteeing business continuity. We were very agile and reactive, innovative also in the way of working, adapting very quickly to this "new normal" and the results are clearly visible. Also, considering that in the first part of 2021 we successfully recovered about 90% of our activities, be them contract subscriptions or deliveries that were delayed last year because of COVID-19. The pandemic has affected all of us, but we have been definitely able to guarantee business continuity, and in this process, we included support to our suppliers who were themselves facing difficulties.

Defence Turkey: Can you list the most important defense programs currently carried out by MBDA and the envisaged time frame for the realization of these programs? What are the most prominent projects that you expect to be realized in 2021?


Aster 30 Missile seen from launching the tactical ground vehicle during the Tactical Evaluation Trials, 2017

© MBDA

Lorenzo MARIANI: MBDA believes that 2021 will be a decisive year for several defense capabilities in Europe. I would start by mentioning the SAMP/T NG contract awarded by OCCAR in March. SAMP/T NG is the air defense system that handles ballistic missiles or very fast cruise missiles, and within the end of this decade it will give France and Italy an enhanced capability to guarantee their airspace protection and protect their people and territories as well as their troops in operations from new emerging threats. At the beginning of the year, an important goal was the commercial launch of the VL MICA NG, which will be supplied to Egyptian vessels. Another contract obtained in these first months of 2021 relates to the SEA CEPTOR installation for an undisclosed customer. We also intend to continue with the future cruise and anti-ship weapon, the so-called FC/ASW program between the UK and France. Here the topic is to replace the SCALP Storm Shadow Family, but also EXOCET and HARPOON. We are now closing the concept phase and we anticipate that we will start the assessment phase, which is a risk reduction phase, this summer. MBDA will continue to invest in cooperation for the endo-atmospheric interceptor that could be the backbone of the wider TWISTER (Timely Warning Interceptor with Space-based TheatER surveillance) program launched under the EU PESCO framework, to provide a European contribution to NATO Ballistic-Missile Defence (BMD). As a member of two partnerships producing Next Generation Future Combat Air Systems (Tempest / FCAS), MBDA will continue to mature capable, affordable, upgradeable, connected, and cooperative effectors for future air dominance.

Defence Turkey: MBDA is taking part in the SAMP-T Air & Missile Defense System Program. Can you elaborate on the current status of the SAMPT/T Program?

Lorenzo MARIANI: As mentioned, in March the ministers of the armed forces FR / IT announced the signature of a contract for the development of SAMP / T NG (New Generation Ground-Air Medium Range / Earth) awarded by OCCAR to EUROSAM, a joint venture of MBDA France, MBDA Italy and Thales. It is a continuation of the Franco-Italian contract notified in 2016, which aimed at the development and integration of a new Aster 30 Block 1 NT ammunition. The new development guarantees the continuation of cooperation for several years and will allow France and Italy to rely on updated capabilities able to defeat new emerging threats. The contract will also finance the navalization of the new Aster 30 Block 1 NT Enhanced Capability ammunition standard, in order to benefit the naval systems of the Aster

The CGI of TESEO MK2/E

family. I would like to point out that this is the only European program to have intercepted (on multiple occasions since 2010 in force training tests and firing) targets simulating ballistic missiles and supersonic anti-ship missiles.

Defence Turkey: What can you share about MBDA's approach towards R&D efforts to develop and obtain new technologies considering the very demanding and ever-changing threat environment? What are your thoughts regarding the financing of R&D?

Lorenzo MARIANI: As a policy we don't give the exact figures of our investments in Research and Development even if it is an important amount. R&D is for sure also part of our cooperation with our customers, because, of course, when we develop new capabilities, it is very often at the edge of technology and very often research and development programs are "shared" with them. An example of this is the new TESEO MK2/E. It is the result of a long-standing relationship with the Italian Navy. Moreover, for larger innovative programs we rely on the most important European research programs: from PESCO to the EDF which is going to help fund the research on the hypersonic technologies. So, funded research is fundamental to provide innovative and strategic products to maintain technological sovereignty; and I would like to stress how important cooperation is in this field, a single nation alone would go far but together we can evolve and grow.

Defence Turkey: How would you summarize MBDA's involvement in Turkey over the last decades? Could you give us a recap of the company's experience in Turkey over the last three decades?

Lorenzo MARIANI: In the last decade, Turkey has made a significant leap in technology by heavily investing in the national defense and aerospace industry. This quantum leap took place in a short time compared to other contexts and was largely possible thanks to substantial investments in national programs, which left less space for cooperative programs.

The experience gained by observing the world scenario is that this approach is a valid initial entry point, but when it comes to developing technological capabilities and "major projects" in the field of fighter aircraft, missiles, and future systems (anti-ballistic, hypersonic, etc.), it becomes quite natural to converge towards international cooperation programs. If Turkey wants to become a global player in the Defense & Aerospace sector, it can be fundamental to plan its inclusion into cooperative programs. It is now largely clear that, except for very few countries in the world, single countries do not have the critical mass to support the economic and technological weight of "big" defense programs by themselves. In this context, Europe in general, and MBDA in particular could be an important and less cumbersome partner than other players on the global stage.

Defence Turkey: On January 28, 2017, BAE Systems and Turkish Aerospace signed a Heads of Agreement to collaborate on the first development phase of the indigenous MMU/TF-X Program. Later, in 2019, Turkish Aerospace unveiled a full-scale model of TF-X, which was showcased together with MBDA's Meteor, ASRAAM, and SPEAR munitions. Considering BAE System's involvement in the project, have there been any meetings or negotiations between MBDA and Turkish Aerospace regarding MBDA's participation in the TF-X Program?

Lorenzo MARIANI: MBDA has been in contact with both Turkish Aerospace (TUSAŞ) and the Turkish Air Force for the TF-X program and has declared its willingness to integrate its products on this aerial platform. The perception is that the main interest concerns the Meteor missile and the added value that this missile could give to the platform on the global market. The experience gained by MBDA on various aerial platforms and with a look at the world context, the consensus is that the Meteor constitutes a real "game changer" for customers who use it. At MBDA we can perceive the Turkish desire to cooperate with the European consortium when the platform development program enters the active phase of arms integration. The priority, at the moment, is probably to be able to carry out the first demonstration flight of the TF-X as soon as possible.

Defence Turkey: As part of Turkey's efforts to develop a national Long-Range Air and Missile Defense System, EUROSAM, Aselsan, and Roketsan signed a Heads of Agreement (HoA) on July 14, 2017, to launch in-depth cooperation in the field of air and missile defense. Following this agreement, the Turkish, Italian, and French defense ministers signed a Letter-of-Intent (LoI) on November 8, 2017, to further strengthen their relationship in defense matters. Previously, there have been some statements about setbacks in the project due to political tensions between Turkey and France. Can you elaborate on the latest status of activities performed under the Concept Definition Study contract?

VL MICA Vertical Launch Short Range Air Defense System

Lorenzo MARIANI: Activities are on-going, but they have certainly lost that energetic push that they had at the very beginning a few years ago. COVID-19 was a factor that slowed it down, but not the only one. MBDA perceived a change of priority in the country towards indigenous products, but also products that could soon find use in conflict situations involving Turkey.

MBDA remains interested in participating in an ATBM program with Turkey, bearing in mind, however, that Italy and France have now entered the active phase of the development of the SAMP/T NG and that in these programs, it is always important to seize the opportunity when they come through. In any case, MBDA is involved in several further development programs in which, if Turkey is willing to participate, and with intergovernmental agreement, we would be glad to find the way through for Turkey and its National Industry.

Defence Turkey: What are the aspirations of MBDA towards a long-term presence in Turkey through cooperation? Can you elaborate on the other programs that MBDA would like to pursue in Turkey and cooperate on with local industry? What is the extent of your collaborations in Turkey?

Lorenzo MARIANI: MBDA continues to cooperate with Turkey on many tactical initiatives (Aspide boosters, Otomat boosters, on-board systems for third countries). When it comes to strategic programs, MBDA is in any case the mirror of Europe and cooperation is possible if supported by an intergovernmental approach, which in the future is conceivable, considering that Turkey is a member of NATO and an important player in the Middle Eastern and Mediterranean basin.

Defence Turkey: On February 11, 2020, MBDA acquired a stake in French software company Numalis, which focuses on the industrialization of Artificial Intelligence (AI) research to promote global AI standardization. For more than ten years, MBDA has been studying Artificial Intelligence and its potential applications in missile systems, given the nature and the criticality of their role during operations. Having deep expertise in artificial intelligence, what can you tell us about MBDA's studies on AI, and how does the company envisage AI's impact on the battlefield, today and in the future?

Lorenzo MARIANI: As our CEO declared, when the agreement was signed, the investment in Numalis is part of MBDA's open innovation policy, aimed at leveraging the best innovative technologies and expertise from the civilian sector. Numalis will give MBDA access to essential building blocks of the future validation – and ultimately certification – processes for the Artificial Intelligence-based applications used in our missile systems. Moreover, MBDA has been studying Artificial Intelligence in order to ensure continuous improvement in the capability of our products. We will make use of AI, but it will have to be explainable, secure, and robust against cyberattack risks and surely include the human factor; the human being, the operator in the end, must remain at the heart of the decision-making process, and the only one who can take critical decisions. The development of automaticity must help increase the reliability of systems and help with decision-making to improve operational performance, so it is going to be an accelerator.

Defence Turkey: As one of the leading companies in the world in the field of missile systems, you are doing business in an ever-increasing competitive defense market. In exports, the Middle East is one of the most important regions, along with Asia-Pacific. In the last years, MBDA set up several local joint ventures to meet the demands in these regions. In 2016, MBDA signed a contract in Doha to supply coastal defense systems for the Qatari Emiri Naval Forces (QENF). In 2019, MBDA opened its first missile engineering facility in the UAE in cooperation with Tawazun. This year MBDA was awarded a contract from the Egyptian Navy for the VL MICA NG (New Generation) air defense system to equip its corvettes. You are also active in India together with Rafale for the induction of Rafale fighter jets into the Indian Air Force (IAF). What can you tell us about your current activities in the Middle East and the Asia-Pacific region? When compared to the market in Europe and the USA, what are the ratios in your annual turnover in the Middle East and Asian-Pacific markets? What can you share about your future goals in these regions?

Lorenzo MARIANI: We have an important presence in Qatar as you mentioned. We have been providing systems for the Qatari corvettes and missile costal defense systems and during 2021 significant deliveries will take place. In the Asia Pacific region, we keep supporting our customers with Meteor missiles. Our missile systems are also operational in many maritime platforms with VL Mica, Aster and Mistral, just to mention some of our products, which are well appreciated in the area.

Defence Turkey: Dear Mr. MARIANI, thank you very much for the interview and your valuable contributions

PN-MILGEM Corvettes to be Armed with MBDA's Albatros NG NBAD System!

by İbrahim SÜNNETÇİ

The Pakistan Navy has decided to use MBDA's new generation product Naval Based Air Defense (NBAD) System Albatros NG instead of the HHQ-16 Medium-Range Air Defense Missile System on PN-MILGEM Corvettes, which are under construction within the scope of the Pakistan Navy MILGEM (PN-MILGEM) Project. The contract of the PN-MILGEM Project was signed between the Main Contractor ASFAT (Military Factory and Shipyard Management Inc.) and the Pakistan Ministry of Defense Production on July 5, 2018, in Islamabad and the construction activities (T0) were started on March 11, 2019.

According to the information I received, within the scope of this last-minute change on the ships' main air defense system a number of modifications have been performed on the PN-MILGEM's original sensors and weapon systems layout. The renewed design of the PN-MILGEM Corvette was disclosed for the first time on April 30, 2021, during the PN-MILGEM-3 Corvette's keel laying ceremony held at Istanbul Naval Shipyard in Tuzla, Istanbul.

As we recall, on March 3, 2021, MBDA announced that it signed the first export contract with an undisclosed international customer for the Albatros NG NBAD System, which uses CAMM-ER (Extended Range) missiles. In the press release, it was stated that the Albatros NG System would become operational in 2024 within the scope of the order. With this acquisition, the Pakistan Navy became the first export customer/user of Albatros NG, and the PN-MILGEM Corvette became the first surface warship to use this new generation medium-range active radar guided air defense system. In addition, the Albatros NG NBAD System will be integrated into the GENESIS ADVENT CMS (Combat Management System) used on the ships.

Within the scope of the PN-MILGEM Project, which covers the construction of 4 corvettes based on the design of ADA Class Corvettes of the Turkish Naval Forces (TNF), two of the ships will be constructed at Istanbul Naval Shipyard Command, and the other two at Karachi Shipyard & Engineering Works (KSEW) in Pakistan. The construction of 4 corvettes is currently underway, and the first ship of the Project is planned to be launched in July 2021 and is to be delivered in Turkey in August 2023 (Pakistan will accept the vessel here, then it will be taken to Pakistan). The steel cutting ceremony of the 4th corvette was held at KSEW in Pakistan on June 15, 2021 with the participation of Chief of the Naval Staff Admiral Muhammad Amjad Khan NIAZI. The 4th PN-MILGEM Corvette is scheduled to be commissioned in February 2025. During the ceremony the renewed design of the PN-MILGEM Corvettes with a pair of 6-cell Maritime Launching System (MLS, for a total of 12 CAMM-ER missile) for the Albatros NG NBAD System was also disclosed for the first time.

© Pakistan Navy

PN-MILGEM Class Corvette and JINNAH Class Frigate Programs

MİLGEM CLASS VESSELS	ADA CLASS	PN-MİLGEM	İ-CLASS
Overall Lenght	99,56m	108,2m	113,2m
Lenght at Waterline	90,55 m	99,69m	105,22m
Beam	14,42 m	14,80m	14,40m
Speed	29+ knot	26+ knot	29+knot
Draught	3,59 m	4,05m	4,05m
Displacement	2,400t	2,926t	3,000t

In 2010 when the Pakistan Navy (PN) was interested in the Turkish Navy's MILGEM Project there were 2 issues at that time; Pakistan did not have the money and the Turkish construction organizations were busier making ships for themselves, so an immediate contract for the Pakistan Navy could not be achieved at that time.

So, when Pakistan finally got through, it was originally thought that the PN would just take the exact model of the TNF's ADA Class (MILGEM) and put it into service. It was thought that on the 4th ship, certain modifications would take place by involving Pakistani engineers and technicians who would receive on-the-job training during the construction of the first ship and the modified design to be based on the TNF's ADA/MILGEM Class would be called PN-MILGEM.

However, what actually occurred was that once the contract was awarded, the PN added a lot of weapons on to the ships. More weapons and more capabilities compared to the TNF's ADA/MILGEM Class.

It was then realized that the original size of the TNF's ADA/MILGEM Class would not sustain the volume of weapons on board so the size and everything had to be changed. So practically the PN-MILGEM is very much different from the TNF MILGEM, it is bigger, its heavier, the weapon systems are different, so the design teams had to conduct completely new work on it.

So, even as the name remains MILGEM the baseline design remains the ADA/MILGEM Class, but in reality, the PN's MILGEM design is completely different from the TNF's MILGEM Class in capability and capacity. Thus, even within the scope of the contract it was initially thought that only the 4th ship of the PN-MILGEM Project would be different, but now all 4 are different from the TNF's MILGEM. Thus, with the PN-MILGEM Project, Pakistan gains the ability to design and build its indigenous warship with the support of Turkish engineers.

As the entire ship is new, as an offset the JINNAH Class designing came in. PN design teams, who took part in the PN-MILGEM design efforts in Istanbul, Turkey together with the Turkish ship designers have started to design a new ship, which is called the JINNAH Class. So, PN-MILGEM is different, and JINNAH is absolutely different.

All 4 ships, 2 being constructed in Istanbul and 2 being constructed in Karachi, will be different from the TNF MILGEM. And after the construction of these 4 PN-MILGEM Corvettes is completed, construction of JINNAH

Class would be started. Since it is a joint design (like the JF-17 of Pakistan Air Force) both Turkey and Pakistan will have rights to sell it and market it if they want.

JINNAH is absolutely a new design. The baseline is almost similar to the PN-MILGEM, but it also very different. It is much bigger. The PN-MILGEM will come in the Corvette category whereas JINNAH will be in the Frigate category. The propulsion systems will be different, PN-MILGEMs have two 4000 Series MTU 20V4000M93L diesel engines (each generate 4,300kW/5,766hp) with a LM2500 gas turbine, whereas in the JINNAH it will be all diesel and it will not have a gas turbine. Also, in the JINNAH Class a number of systems will be indigenized. The Pakistan Navy is looking for indigenous systems. As of June 2021, the JINNAH Class is still in the Preliminary Design Phase. Once the Preliminary Design Phase is completed then there would be a cost estimation effort on how much this design will cost. Based on the concept, engineers would then make a cost estimation on how much is this ship going cost. And then they add weapons, and the cost would increase further, and then the Detailed Design Phase would be performed. Somewhere in 2022 the initial shipbuilding contract, which would allow the start of Detailed Design Phase, is expected to be awarded. Because the detailing study is can only be conducted done after the contract award. If PN Headquarters allows it, a conceptual model of the JINNAH Class will probably be on display during the IDEF '21 Exhibition in Istanbul.

PN-MILGEM Corvettes & Albatros NG NBAD

With an overall length of 108.2 m, a width of 14.8 m, a draft of 4.05 m and a displacement of 2,926 tons, PN-MILGEM Corvettes sit between the 2,400-ton ADA Class Corvettes and the 3,000-ton ISTIF Class Frigates.

When we look at the previously shared Computer-Generated Images (CGI) of the vessels, the PN-MILGEM Corvettes had a 16-cell Vertical Launching System (VLS) for the HHQ-16 Medium-Range Air Defense Missile System located just behind the Leonardo (Oto Melara) 76 mm Super Rapid main gun. The China Aerospace Science and Technology Corp (CASC)'s HHQ-16/LY-80N medium-range semi-active radar-guided air defense missile system is also used in Type 054A/P Frigates (with 32 cell VLS) currently under construction in China for the Pakistan Navy.

Measuring 5.2m in length, 340mm in diameter and weighing around 650kg, the HHQ-16 is said to have a maximum range of 42km. The HHQ-16 has a 70kg warhead and is claimed to have an interception altitude of between 15m and 18km (the extended-range version of the missile, the HHQ-16B, has a range of 70km). For target illumination requirement the PN-MILGEM Corvettes were supposed to be installed with two Type 345 Target Illumination Radars (NATO code MR-90 Front Dome), the first one would be located just in front of the mast and the other would just behind the funnel.

However, with recent improvements/ modifications on the PN-MILGEM's original sensors and weapons systems layout the 16-cell VLS for the HHQ-16 Medium-Range Air Defense Missile System is now replaced with a pair of six-cell modules of the Albatros NG Maritime Launching System (MLS, a Soft Vertical Launch/ SVL system, it uses a cold gas generator to eject the missile from its canister) that is based on the compact design developed by MBDA UK for the Royal Navy's Type

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26 and Type 31 frigates and Type 345 Target Illumination Radars for the HHQ-16 Missiles were removed. The PN-MILGEM Corvettes will be also fitted with the Platform Data Link Terminal (PDLT), featuring four small arrays, of around 40cm per side, which can be mounted on the main mast to offer 360° coverage, or rearranged inside two turrets on the upper deck of the ship, each one accommodating three arrays covering 180°, as already adopted on Type 23 platforms. The PDLT will provide the two-way communication between the ship and the CAMM-ER missile; target positional updates can be uplinked from the ship to the missile in flight, while missile status information and diagnostics can be sent back to the ship.

The Albatros NG is a new generation NBAD System capable of providing self and local area defense against evolving airborne threats at ranges exceeding 40km. The system uses the ER (Extended Range) variant of CAMM (Common Anti-air Modular Missile), which features advanced RF digital seeker combined with two-way RF data link (with 360° coverage) for target updates and utilizes Soft Vertical Launch technology. The CAMM-ER missile has already been selected by customers around the world for both naval and ground-based air defense. The CAMM-ER shares the same characteristics as the original CAMM except for an extended booster/sustainer rocket motor (developed specifically for the MBDA missile by Italian company Avio) in a larger calibre (190 mm) propulsion section which significantly increases the engagement range to 45+ km. The CAMM-ER is said to have an interception altitude of between 12km to 15 km. CAMM-ER weighs 160kg (350lb), is 4.2 m (14ft) in length and 190mm (7.5 in) in diameter. Each Albatros NG Firing Unit manages up to 12 missiles, requiring the installation of multiple Firing Units should a higher number of missiles be required. Thanks to the fire-and-forget capable CAMM-ER/Albatros NG NBAD System, the PN-MILGEM Corvettes will be able to engage more air targets at the same time compared to the semi-active radar-guided HHQ-16 Medium-Range Air Defense Missile System and perform missions with higher performance in the EW threat environment.

CAMM-ER Missile

MBDA has successfully completed a firing of the CAMM-ER Air Defence Missile against a manoeuvring target on June, 2021

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The PN-MILGEM Class Corvettes will also be equipped with a total of 6 Harbah Anti-Ship & Land Attack Cruise Missiles (ASCM/LACM with an estimated range of 450km to 750km) or another new indigenous classified missile system that is still under development (claimed to have supersonic flight capability), two ASELSAN 25 mm STOP Remote Controlled Stabilized Naval Guns (at the port and starboard deckhouses), and a ASELSAN GÖKDENİZ Close-in Weapon System (CIWS). Within the scope of recent improvements/modifications on the PN-MILGEM's original sensors and weapons systems layout the torpedoes have been also changed.

The induction of PN-MILGEM Corvettes will significantly enhance the maritime defense and deterrence capabilities of the Pakistan Navy. Featuring state-of-the art weapons and sensors, these corvettes will become a core element of the PN's kinetic response to traditional and non-traditional challenges and to maintain balance of power in the Indian Ocean Region

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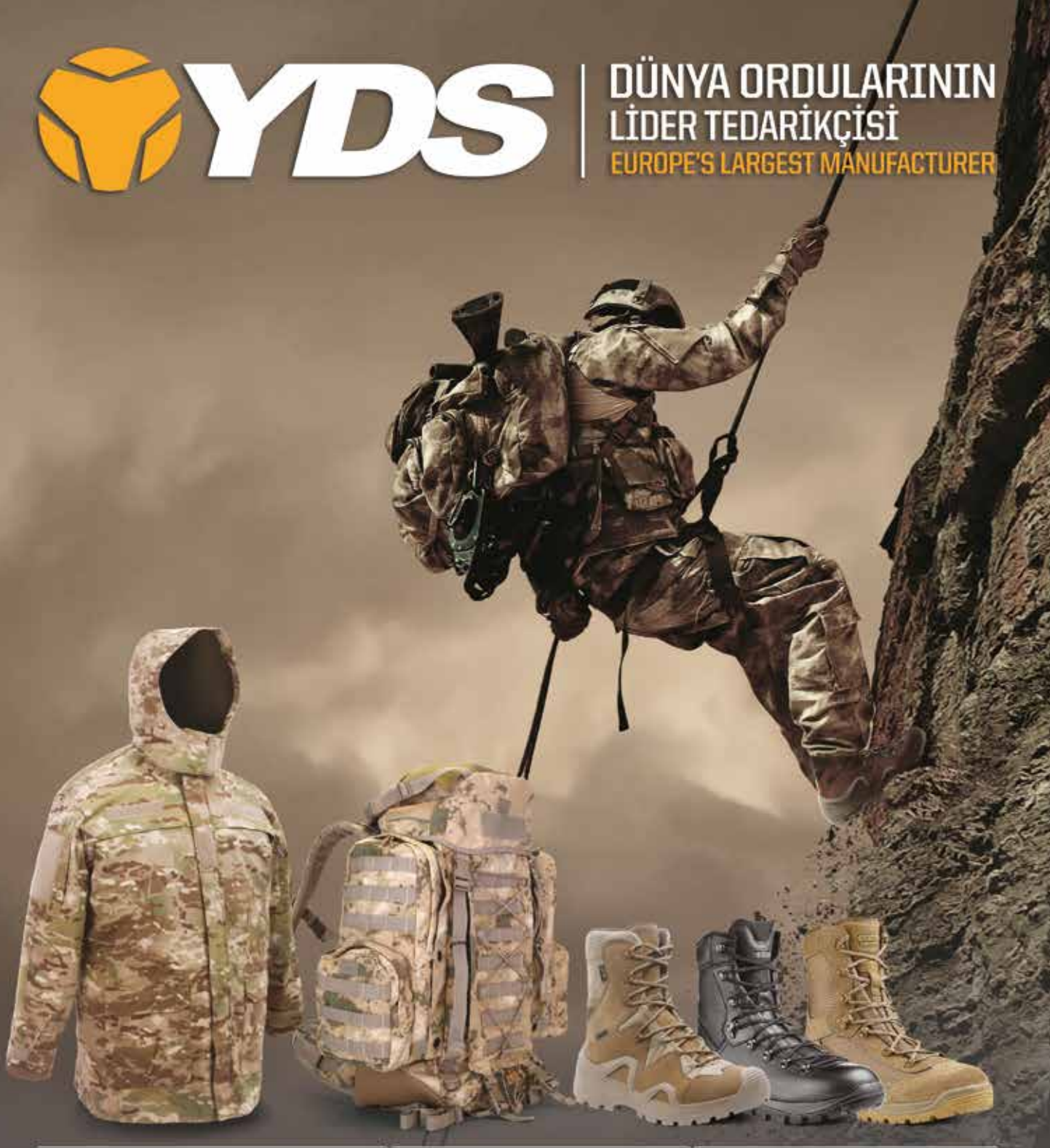

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TEI-PD170-DT Turbodiesel Aviation Engine Through the Eyes of an Engineer

@PistonHeadThyme

Developed by TUSAŞ Engine Industries Inc. (TEI) with the support of the Presidency of Defense Industries (SSB), Turkey's first domestic and national turbodiesel aviation engine, the PD170, is considered as one of the best diesel aviation engines in its class, based on its power/weight ratio.

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Developed to power Medium-Altitude Long-Endurance (MALE) Class Unmanned Aerial Vehicles (UAV), the TEI-PD170 diesel aviation engine is very light thanks to the cylinder block and cylinder head cover made of aluminum alloy. Following the acquisition of high-temperature strength and wear resistance aluminum alloy technology as part of the AYNA Project signed between the SSB and İTÜ-İTÜNOVA TTO, and VIG Metal, the domesticity rate of engines has reached very high levels. When we look at the cylinder head cover of the new generation DCI type engine with Common Rail technology and completely managed by a domestic and national Electronic Control Unit (ECU), we see that it has a double overhead camshaft (DOHC) mechanism. Since TEI-PD170 is planned to power the aircraft, a timing belt is preferred to drive the camshaft instead of gear, chain, or shaft to be lighter. I believe that the exhaust valves are made of standard steel alloy, while the intake valves are made of titanium for the engine to provide more torque and power. Titanium intake valve springs are 3-4 times harder than standard valve springs. In this way, the camshaft cams close much faster when the pressure on the intake valves is terminated, thus minimizing the leakages.

TEI-PD170-DT (Dual Turbo), which has very efficient fuel consumption, has 4 cylinders with a total volume of 2,100cc. Compared to the TEI-PD180-ST (Single Turbo) engine, which has one large-diameter turbocharger but is 10kg lighter and 10hp more powerful at sea level, the TEI-PD170-DT has 2 serial-connected turbochargers (two-stage turbocharging) to maintain the power it produces at high altitudes. The reason for choosing a serial turbocharging system is that the air compressed by the first turbocharger is then further compressed by the second turbocharger so that the engine is less affected by the low oxygen amount at high altitudes. If parallel turbocharger configuration were preferred, the "headers" (exhaust manifolds) shared by the 4 cylinders would be divided into two, and the exhaust gas pressure would be shared halfway between the two turbochargers. In this case, due to the small volume of the engine, the exhaust gas pressure would not be able to rotate the turbine blades at sufficient speed, and the engine would lose power. Smaller diameter turbochargers could be used to prevent this, but in this case, since the diameter of the snail fans would also get smaller, the compressor output would also decrease, and nothing would change. Therefore, only a serial turbocharging system can be used. All turbochargers used on the TEI-PD engine family also have a "wastegate" system. In short, this is a security system that regulates the maximum boost pressure in turbocharger systems to protect the engine and the turbocharger. The turbine blades, which operate at around 600°C and are under a great load due to centrifugal force, reduce their efficiency by changing their angle to allow excess exhaust pressure to bypass the turbine and limit their rotational speed. It is not difficult to estimate the load on turbine blades rotating at 200,000 RPM (revolutions per minute) due to centrifugal force. However, when turbochargers without a "wastegate" system are used, the engine's power output will be much higher. While the turbocharger on the 172hp TEI-PD170-DT engine has a typical boost pressure of 0.9 – 1.8 bar, the TEI-PD222 engine, which was increased to 2.0 – 3.0 bar, provides more power and torque, and the power-to-weight ratio has been improved further. There is also a model named TEI-PD222-ST that is 10kg lighter with a single turbocharger. From PD155 to PD222-ST, all engines in the expanding diesel engine family developed by TEI have in-line cylinder block arrangements. Compared to V or VR type engines, in-line engines stand out with their ease of production and lower cost advantage.

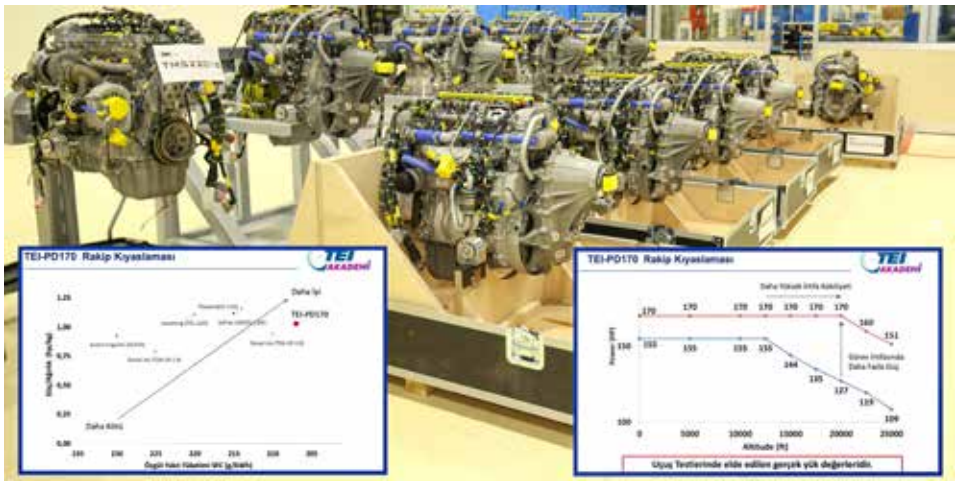
All members of the TEI-PD Aviation Engine Family use a 180-degree Flat Plane Crankshaft. Therefore, the ignition angles (crank angle) of the crankshaft are 180-360-540-720 degrees, respectively. In our 4-stroke engine, the piston completes four

separate strokes (full travel of the piston along the cylinder) during the 720-degree rotation of the crankshaft. These are Intake, Compression, Combustion, and Exhaust, respectively. When we consider the ratio 360(2)/4=180-180=0 (our block angle is 0 degrees since it is an in-line engine) and the crankshaft angle is 180 degrees, we see that our engine has a very balanced structure. Although there is no balance problem in in-line engines since the block angle is 0 degrees, the straight crankshaft has chronic vibration problems at an acceptable level at certain rev ranges.

When we look at this type of crankshaft at a 180-degree (horizontal) angle, we see that when the arm bearings are at the top dead center or bottom dead center, they form a straight line named "Flat-Plane Crankshaft." Although engines with a 180-degree flat-plane crankshaft have both advantages and disadvantages compared to engines with a 270-degree cross-plane crankshaft, they have more disadvantages. When we look at the 270-degree cross-plane crankshaft from a 180-degree horizontal angle, the arm bearings form the "+" shape.

The flat-plane crankshafts may seem more efficient because of their advantages, but this is a relative concept.

They are lighter as there will be less counterweight. Therefore, since they will be exposed to less inertia and centrifugal force, they allow higher rotational speed and therefore produce more power.



If we look at the disadvantages of flat-plane crankshaft engines, they are very long due to the 180-degree angle difference between the sleeve bearings, and they produce less torque as their ignition gap is 50% more than the cross-plane crankshaft engines. The engine can reach its true potential at very high revs. However, considering that it is impossible and unreasonable to achieve high RPMs with diesel engines, it is also unnecessary for the TEI-PD series engine family. Additionally, since the engine needs a significant amount of oxygen for high RPM, we can see that its speed drops severely due to lower oxygen at high altitudes. Therefore, as the altitude of the aircraft increases, the advantages offered by the flat-plane crankshaft decrease.

If we look at the advantages of the cross-plane crankshaft, the angle difference between the sleeve bearings is only 90 degrees. In a 4-cylinder engine with a cross-plane crankshaft, one piston is fired for every 90-degree rotation of the crankshaft, while in a flat-plane crankshaft, it is 180 degrees. The cross-plane crankshafts produce higher torque because their firing interval is shorter. Therefore, they have a much better throttle response in the entire rev range. An example is the classic V8 American Muscle cars. Looking at the dyno test results, they have a smooth torque and power curve at lower and middle RPMs. Because they are much more balanced, they have lower vibration and a very pleasant-sounding acoustic signature.

The disadvantages are that the crankshaft is both larger and heavier, as more counterweights will be used. Because the crankshaft is heavier, it has more inertia, so it is reluctant to turn at high revs. Since even 1 kilogram is vital in an aviation engine, extra engineering work is required to lighten the engine.

If we use a cross-plane crankshaft in the TEI-PD170 engine, maybe it will produce 160hp instead of 172hp at full throttle, but it will be able to go up to 25,000ft - 30,000ft altitudes without loss of power. Moreover, with the development of material diversity in Turkey, the engine can be expected to become lighter. The weight and inertia of the cross-plane crankshaft can be reduced by using titanium with a relative density (specific gravity) of 4.51gr/cm3 instead of forged steel with 7.73-7.83gr/cm3 in the connecting rods. This will allow higher RPMs than before, although not as much as a flat-plane crankshaft

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HMS Defender (D36)
Hosted DIT's UK Industry Day Event in Istanbul

by İbrahim SÜNNETÇİ

Having sailed from her homeport of Portsmouth on May 1, 2021, the HMS Defender (D36), one of 6 Type 45 Daring Class Air Defense Destroyers in the Royal Navy (RN), arrived in Istanbul on June 9th for a port visit. She berthed at Sarayburnu Port together with her Dutch consort De Zeven Provincien Class Air-Defense Frigate HNLMS Evertsen (F805), both part of the UK led Carrier Strike Group 2021 (CSG21) deployment to the Indo-Pacific region.

Following a 5-day port visit for vital replenishment conducted prior to entering the Black Sea, the HMS Defender departed Sarayburnu Port on June 14th and sailed through the Bosporus with the Dutch frigate HNLMS Evertsen to conduct maritime operations in the Black Sea demonstrating interoperability with their allies in the region.

Following their Black Sea visit (Expected to last 20 days and accompanied by HNLMS Evertsen the HMS Defender [D36] Destroyer departed Black Sea and transited Bosphorus towards Mediterranean on July 2, 2021), the HMS Defender and the HNLMS Evertsen will re-join the rest of the Carrier Strike Group before they head through the Suez Canal. Travelling over 26,000 nautical miles (further than the distance around the world at the equator) the UK led CSG21 will visit more than 40 countries over the next 7 months from the Mediterranean to the Indo Pacific; including Singapore, the Republic of Korea, Japan and India. The CSG21 is made up of the aircraft carrier HMS Queen Elizabeth, Type 45/ Daring Class destroyers HMS Diamond and HMS Defender, Type 23 frigates HMS Kent and HMS Richmond, and Astute Class submarine, RFA Fort Victoria, RFA Tidespring, U.S.S. The Sullivans of the US Navy and HNLMS Evertsen of the Royal Netherlands Navy.

While in Istanbul from June 9 - 14, 2021, the HMS Defender hosted a reception for representatives of the Turkish Government, the Armed Forces and the Defense & Aerospace Sector on the evening of June 9th during


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which Bridge and Operations Room teams demonstrated the Type 45 Destroyer's response to a small boat threat and air defense capability and her Royal Marines Boarding team demonstrated their close quarter battle skills. The HMS Defender's chefs also displayed their expertise with delicious canapés inspired by classic British dishes. A dinner with prestigious guests including the Governor of Istanbul was also held onboard. All events were carefully planned to ensure they were 'COVID-secure'.

Within the scope of her port visit to Istanbul, the RN's cutting-edge air defense destroyer HMS Defender also hosted a UK Industry Day event on the afternoon of Thursday 10th, June 2021. Organized by the Department for International Trade (DIT) of the UK Government, this event provided an ideal opportunity to discuss trends and to work together to foster further economic growth both in the UK and Turkey, from the seas to space. Possible areas of cooperation between the UK and Turkey were defined in areas of Technology, Advanced Manufacturing, Clean Growth, Defense and Security Sectors. In this context an exhibition was held on the flight deck and hanger of the HMS Defender with the participation of Airbus Defense & Space (ADS), BAE Systems, Caterpillar Defense UK (CAT UK), FNSS (A JV Company owned 51% by Nurol Holding and 49% by BAE Systems), Inmarsat, Leonardo UK, Rolls Royce, Shell, Thales UK and Vodafone. The aforementioned companies are taking part in Turkey's on-going major aerospace programs including TF-X, HURJET, A330 MRTT, Liaison & General-Purpose Aircraft, A400M, T129 ATAK, Training Helicopter, ALTAY MBT, Various Armored Wheeled Vehicle Programs and Military and Commercial Satellite Programs.

High-ranking representatives from the Turkish Naval Forces (Commander of the Istanbul Naval Shipyard Rear Admiral [Lower Half/LH] Recep Erdinç YETKİN and Turkish Naval Forces Naval Technical Commander Rear Admiral (LH) İbrahim Rıza ADANIR), Presidency for Defense Industries (Vice President Serdar DEMİREL, Head of Naval Platforms Department Alper KÖSE and Head of Fixed Wing Platforms Department Abdurrahman Şeref CAN) and Defense & Aerospace Sector attended the event to which Defense Turkey Magazine was also invited. Turkish Space Agency President Serdar Hüseyin YILDIRIM was also among the attendees of the event.

Providing a short keynote speech at the event, the Commanding Officer of the HMS Defender, Commander Vince OWEN said: "It is a great privilege to have the opportunity to represent Global Britain in Istanbul.

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The Commanding Officer of the HMS Defender, Commander Vince OWEN

Turkey is an important partner and NATO ally. I am proud to have been able to showcase the best of Britton whilst alongside in Istanbul. I am very grateful to Turkey for extending such a warm welcome to us whilst respecting COVID-19 restrictions. We were built in 2009, 152 meters long and 8,000 tons. I've got 240 men and women on board, we're into our first month of the 7 ½ month deployment that will see us go to the Black Sea next and then after that coming back through Suez and out to the Indo Pacific region and to get back to the UK by Christmas. And the main role of this ship is an air defense destroyer. You'll see as you come in the radar. We got the big ball at almost 40 meters above the sea level (this greatly increases the ship's radar horizon and therefore warning of sea-skimming threats), cutting edge phased array radar, you can see out at range up to 2,000 contacts at one time linked in with our Sea Viper System and really capable highly critical air defense platform to deliver that capability. I think that's all I have to say… If any of my crew can help, please ask. I'll hand you over to Jane now for a few words and then afterwards there's food, drinks and refreshments available. Thank you for coming on board."

Featuring gallium arsenide (GaAs) semiconductors, multiple low power modules and air cooling the all-seeing eye SAMPSON Multi-Function Radar (MFR) is integral to the air defense capabilities of the RN's Type 45 Destroyers. The distinctive SAMPSON antenna is mounted in a single carbon-fiber composite frame, which holds two hexagonal back-to-back planar arrays. The two arrays have a 120º field of view but by rotating them and using steerable beams, complete 360º coverage is maintained at all times. Two semi-circular radomes cover the arrays to complete the big ball shape, which is about 4.8 meters in diameter. Operating in the S-Band between 2 – 4GHz, SAMPSON MFR's antenna is rotated at 30rpm. Having a maximum detection range of at least 250nm and track about 2,000 separate targets simultaneously SAMPSON can guide up to 16 Sea Viper missiles in flight.

Taking the chair after Commander OWEN, Jane GRADY, Deputy Trade Commissioner for Eastern Europe and Central Asia at Department for International Trade (DIT) stressed that they place great importance on Turkey and their cooperation with the Turkish Defense & Aerospace Industry. "I am acting as Her Majesty's Trade Commissioner for our region. Turkey is a critical market for the UK in terms of our trade investment relationships, but it goes way beyond that as many of you know. And from Istanbul we oversee our region, which consists of 14 markets into Central Asia including Russia as well. Turkey is of course the jewel really; I think in that region in terms of potential for developing relationships and not least of course in the defense sector. So, it's a real privilege that you are here with us today both on the warship and also to meet some of our outstanding companies that are exhibiting today, and it is an opportunity I hope for people to meet and discuss and potentially build partnerships for the future, because that's what global Britton is about. We're about reaching out more than ever before to our friends and allies, building those critical partnerships not least in the trade and investment sphere and of course, the Free Trade Agreement (Turkey and the UK Tuesday signed a historic Free Trade Agreement on December 29, 2020 and it took effect on January 1, 2021) that was put into place at the back of last year to protect £18 Billion of trade between our countries and that was a key priority for the UK as we formally departed from the EU. And of course, we now look forward to developing that even further with a further and more comprehensive free trade agreement in sight with negotiations due to start on that at the end of 2022. So, there's a lot to look forward to I think in the relationship. But again, back to those companies that are with us today: So we have Rolls-Royce, Caterpillar, FNSS, Airbus, Leonardo, Thales, Shell, Vodafone, Inmarsat and BAE Systems, and they're all in hall today in the hangar so please do reach out to them. These companies operate in a diverse range of innovative technology sectors, which I think speaks


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Jane GRADY, Deputy Trade Commissioner for Eastern Europe and Central Asia at Department for International Trade (DIT)

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to the UKs steps of know-how in terms of innovation and partnership. So, we cover sectors here today such as energy, defense obviously, aerospace and space, engineering and communications. It's quite a wide array there and just looking at those companies gives you a taste of the UK's ambition in terms of international partnership. So just take some of those companies, they've already got fantastic international partnerships. If we look at Shell in terms of the Netherlands, Thales in terms of France and of course Leonardo and Italy and of course Turkey with FNSS. So today is very much about partnership and building that out even further. And indeed, for my department, the Department of International Trade (DIT), technology is at the heart of what we are trying to do in terms of our global partnership ambition. So, I think today is a great event to do that, and so without further ado, I'd just like to say a great thanks again, huge thanks for hosting us Commander, and crew, last night we had a fantastic reception it was wonderful and today is our Industry Day. So, thank you very much again and colleagues, friends please do make the most of the next couple of hours, and I hope to say hello to many of you. Thank you."

Notes on Exhibiting Companies

Airbus Defense & Space (ADS) presented its A330 MRTT and A400M airlifter programs at its stand. You can read detailed articles on the TurAF A330 MRTT and A400 Retrofit Programs in the 108th issue of Defense Turkey Magazine. ADS is also one of the bidders of the Liaison & General-Purpose Aircraft (GPA) Program with the C295 aircraft and the Turkish Land Forces' Training Helicopter Program (covers the direct procurement of 15 [+15 optional] single engine helicopters) with its H125 Helicopter. The SSB launched a tender in 2016 to procure a total of 9 Liaison and General-Purpose Aircraft (GMU/GPA), 6 for the Turkish Land Forces and 3 for the Turkish Police. The Request for Proposal (RFP) document prepared as part of the Project was published by the SSB on June 21, 2016. In 2019 Gendarmerie General Command's General Purpose Aircraft requirement also included in the GPA project. According to Gendarmerie General Command's 2019 Activity Report the GPAs would be utilized to ensure the dispatch of large operation units together with their equipment and materials in a short time between long distances without being affected by meteorological conditions and the project cost would be financed through the national budget. However, the number of GPA to be procured for the Gendarmerie General Command has not yet been publicized, even the 2019 and 2020 Activity Reports did not contain any information on how many GPAs will be procured to meet the Gendarmerie General Command's requirement. According to our sources, the Liaison and General-Purpose Aircraft (GPA) Project is not active as of June 2021 due to budget constraints and has been shelved for a while until the budget problem is resolved. Meanwhile Turkish Police (Aviation Department) is said to have a plan to lease a number of C295 medium transport aircraft from its own budget to airlift its equipment, personnel and ammunition in a faster and secure manner in one go. Currently, they use civil aircraft to carry out this need and personnel, equipment and ammunition are transferred separately due to safety precautions, and consequently this extends the transfer time and increases the costs.

According to our sources, to meet the Turkish Police Aviation Department's urgent transport aircraft requirement, the procurement model was preferred in the Manned Airborne Intelligence, Surveillance, and Reconnaissance (MAISR) Aircraft Program of the Turkish Land Forces Command. To meet their urgent requirement, the SSB had leased five second-hand Manned Airborne ISR Aircraft based on the Beechcraft King Air 350ER for two years under a US$70 Million contract (20,000 flight hours in total/4,000 hours per plane). The cost of a two-year comprehensive logistics support package to keep all aircraft and systems ready for duty 24/7, including the Ground Data Terminal, Remote Display Terminal, and Image Distribution and Storage System was also included in the US$70 million deal. Soon after the 20,000-flight hour leasing/service procurement period of the King Air 350ER MAISR Aircraft expired, a follow on 36-month or 25,000 Flight Hour Service Agreement was signed for five aircraft under the US$80 Million contract, and at the end of the leasing period the MAISR Aircraft were donated to the Turkish Land Forces.


© Defence Turkey

Turkey's next generation National Combat Aircraft (abbreviated as MMU in Turkish), also known as TF-X is being developed by Prime Contractor Turkish Aerospace (TUSAS) with technological assistance from BAE Systems. 100 BAE Systems engineers are currently working under the TF-X Program and the company also provides critical subsystems for both TF-X and HURJET aircraft.

Caterpillar Defense supplies diesel engines and engine subsystems to Turkish armored vehicle manufacturers, for example its diesel engines powers FNSS' PARS and Harimau (Black Tiger) Medium Tank being delivered to the Indonesian Army. During the IDEF '19 Fair, a Memorandum of Understanding (MoU) was signed between the Turkish MoND and Caterpillar Defense UK (CAT UK) on the development of a new powertrain composed of a 12 cylinder (V12) 1,200hp diesel engine coupled with an Allison X1100-5A3 Transmission for use on FIRTINA-II Self-Propelled (S/P) Howitzers. The officials of the company informed me at that time that the engineers of the 1st ABFM would also take part in the development process of the new engine that would be based on an existing Caterpillar Defense UK engine's core and since the engine that was planned to be ready for use in 2022 would not contain any components or sub-systems subject to ITAR restrictions, no restrictions would be experienced in its exports (ITAR-Free). However according to CAT UK officials with whom I met during the UK Industry Day event, following the MoU, the formal contract was not signed with CAT UK, Turkey rather has selected another company from an undisclosed country (I guess this unnamed country is Ukraine) which offered better proposals in terms of budgets. Development work on the new engine is expected to be completed in 2021 and it is planned to be tested on the FIRTINA-II S/P Howitzer in 2022.

Rolls-Royce provides LHTEC CTS800-4A turboshaft engines for T129A/B Phase I/II ATAK Helicopters and for T625 GÖKBEY Turkish light Utility Helicopters via its joint venture with Honeywell. In addition, the company has also shown interest in the Turkish TF-X Program, but according to our sources Turkey will soon sign a contract with Ivchenko Progress from Ukraine for cooperation in the development of 35,000lb class turbofan engines to power TF-X aircraft. Rolls Royce also wants to supply MT30 marine gas turbines under the TF-2000 Air Defense Destroyer Project. Part of Rolls-Royce Power Systems MTU on the other hand supplies 4000 Series MTU 20V4000M93L diesel engines both for ISTIF Class Frigate TCG Istanbul and PN MILGEM Corvettes.

As a global key player in Aerospace, Defense and Security based in Italy, Leonardo also has a business in the UK. With its origins in Basildon since 1952 (under the Marconi name) Leonardo UK (formerly Selex ES) designs, develops and manufactures products for national security and military uses as well as complex civil infrastructure management. Leonardo is one of the bidders of Liaison & General-Purpose Aircraft (GPA) Program with the C-27J aircraft and the Turkish Land Forces' Training Helicopter Program (covers the direct procurement of 15 [+15 optional] single engine helicopters) with its TH-119/AW119 Helicopter. However according to our sources, due to budget constraints both the GPA Program and Training Helicopter Program, which is expected to cost around US$50 to US$70 Million, have been shelved for a while until the budget problem is resolved. Leonardo has undertaken an active role as a subcontractor in the TF-X and HURJET Programs and serves as the Prime-Subcontractor in the T129 ATAK Program and as the Prime Contractor in the MELTEM-III Program (6 P-235 MPA and 3 C-72 Maritime Utility Aircraft).

HMS Defender (D36) Destroyer

Launched in December 2009 the HMS Defender (D36) is the 5th of the Royal Navy's 6 Type 45 Daring Class Air Defense Warfare Destroyers, which often is regarded as one of the most advanced warships in the world. Though her primary role is to provide the Fleet with air defense using the ferocious Sea Viper (ASTER 30 Block I) anti-air missile system, she is a truly versatile platform. The ship has a 48-cell Sylver A50 VLS, for

a mix of up to 48 ASTER 15 missiles (range 1.7–30 km) and ASTER 30 Block I missiles (range 3–120 km). According to open sources during an 'intensive attack', a single Type 45 could simultaneously track, engage, and destroy more targets than 5 Type 42s, its predecessor could.

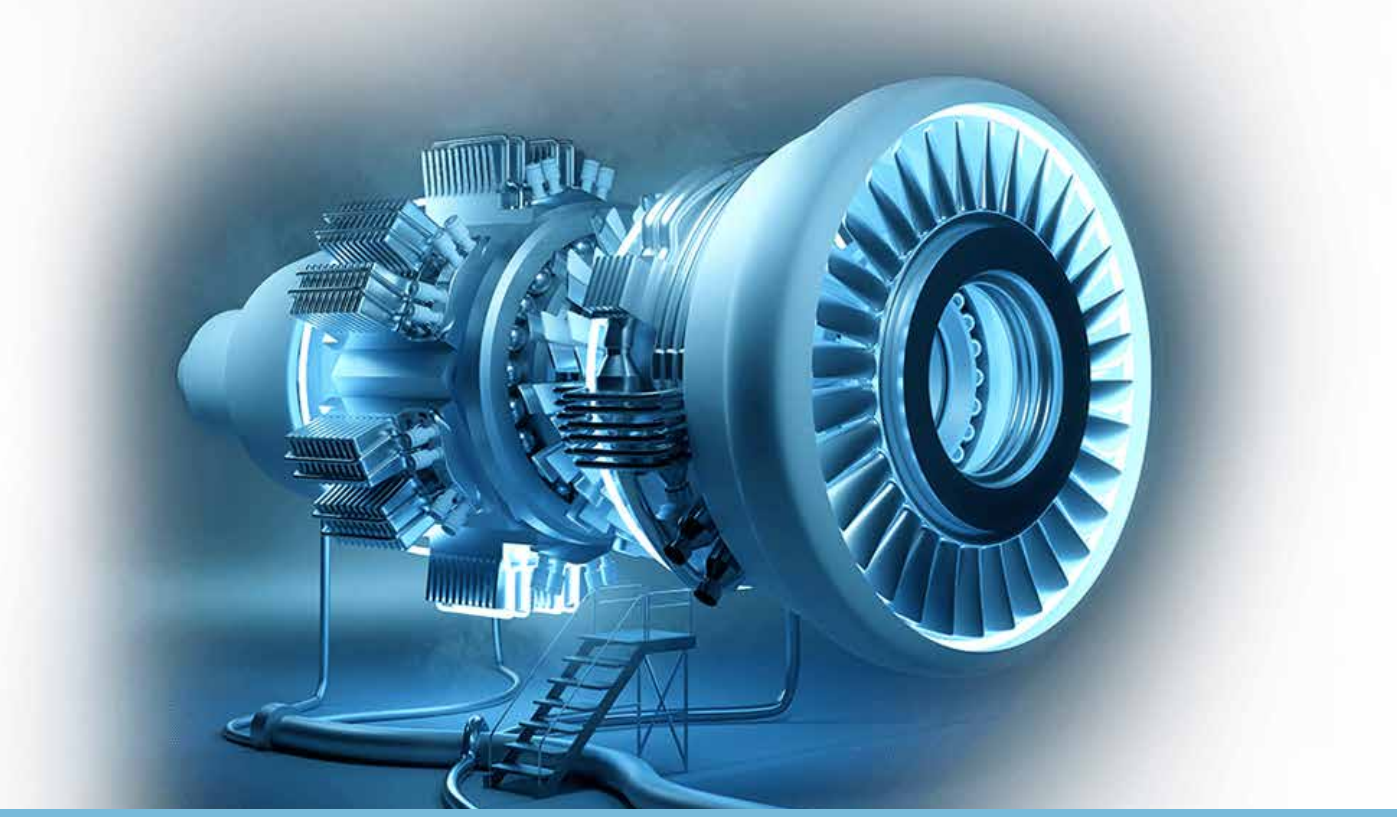
However, since their introduction into service Type 45/Daring Class Destroyers have experienced ongoing problems with the reliability and resilience of their all-electric power and propulsion system (in time this turned into Achilles heel of this class) dubbed the Integrated Electric Propulsion (IEP) System operating through twin shafts and comprising a pair of Rolls-Royce 21MW-rated WR-21 marine gas turbines and a pair of Wärtsilä 12V200 diesel generator sets rated at 2MW each. Problems with the intercooler-recuperator fitted to the Type 45's WR-21 gas turbine engines have caused complete propulsion failures. However, removing the entire WR-21 marine gas turbines would be an enormous task and the PIP is instead focused on the removal and replacement of two Wärtsilä 12V200 diesel generator sets with three more powerful MTU Series 4000 diesel generator sets. The Type 45/Daring Class Destroyers will then change their standard operating procedure to cruise on its diesels and only use the GTs for higher speeds. Launched under a contract awarded on March 21, 2018 by the


© Royal Navy

UK MoD to BAE Systems, BMT Defense Services and Cammell Laird Shipyard, the Type 45 Power Improvement Project (PIP) is designed to rectify these problems and put an end to the reliability issues which continue to limit the availability and dependability of the Type 45 Destroyers. The PIP implementation work would take around 12 months and is scheduled to be incorporated into the planned maintenance for the ships. The HMS Dauntless is the first Type 45 Destroyer that will undergo PIP upgrade at Cammell Laird shipyard to cure the propulsion problems that have plagued this class. The HMS Defender has not yet received the major Propulsion Improvement Package (PIP), which is scheduled to begin in 2023. In the meantime, the HMS Defender and the other Type 45/Daring Class Destroyers that have not yet received PIP upgrades are still able to be deployed globally using various temporary fixes and operating restrictions.

In reply to our questions on the PIP Project, Commanding Officer of the HMS Defender Commander Vince OWEN, who took Command of the HMS Defender in May 2020, underlined that the HMS Defender would receive the PIP upgrade during her planned lengthy dry-docking and refit period in 2023. And following the PIP, the ship will also receive an AIP upgrade to update its onboard equipment. Within the scope of this software-based AIP upgrade phase under a 10-year schedule, Type 45 Destroyers will receive around 30 software upgrades to update outdated onboard hardware. Commander OWEN stressed that, even though there was particular problem with the propulsion system, the HMS Defender has a very high readiness figure, now being consistently above 80% and that she will spend 7.5 months at sea in 2021. According to Commander OWEN following her refit the HMS Defender was able to reach 33.8 knots at full load during sea trials.

Following her 18-month major refit in Portsmouth conducted by BAE Systems the HMS Defender was accepted back into the RN Fleet during the first half of 2018. During the refit period the HMS Defender was integrated with the Shaman Communications Electronic Support Measures (CESM) System that was designed to gather signals intelligence (SIGINT). The AS-4692 VHF/UHF tapered slotted array direction finding/acquisition array of the Shaman System is fitted on the upper part of the pole mast and the AS-4293A VHF/UHF omnidirectional acquisition arrays are fitted half-way up the foremast and on the hangar roof. Shaman is based on the US Navy's AN/SSQ-130(V) Ship Signal Exploitation Equipment (SSEE) Increment F cryptologic exploitation system. 7 sets have been purchased from the United States at a cost of around $90M and will eventually equip all 6 Type 45s, plus a set for shore-based training. The Shaman CESM allows the passive interception of adversaries' transmissions across a broad part of the electromagnetic spectrum. The system can analyze, geo-locate and in some cases may be able to decode encrypted communications. Fitted with the Shaman CESM the HMS Defender can loiter off a coastline and will be able to record signals from mobile phones and military and government radio communications. At sea, intercepts may provide critical detail and forewarning about the actions of adversary's naval units. It can also monitor the communications of allied countries



ZW3D CAD/CAM/CAE Solutions in the Defense Industry

ZWSoft, the developer of **ZWCAD**, **ZW3D** and **ZWSIM** software, is an important CAD/CAM/CAE software player with over 30 years of experience, 6 R&D centers and over 1,000 employees in the CAD/CAM market. It has 900,000 licensed users in over 90 countries around the world.

ZW3D is an integrated CAD/CAM/CAE software that covers the entire process of product development, with the fastest design base in Solid-Surface Hybrid operations, intelligent CNC strategy from 2-axis to 5-axis, and various analysis solutions.

ZW3D is used successfully in sectors such as Automotive, Molding, Machinery, as well as in the defense and aviation sectors.

ZWCAD is user-friendly 2D CAD software that offers professional solutions in the field of 2D design. For companies engaged in mechanical designs, ZWCAD Mechanical offers a complete solution. ZWCAD is used in almost every engineering and manufacturing sector all over the World.

ZWSIM is ZWsoft's innovative and powerful analysis solutions platform in the CAE world. With ZWSIM Meshworks, you can prepare high quality and easy mesh, with ZWSIM Structural you can perform structural analysis on your models and with ZWSIM EM you can perform electromagnetic field analysises.

Some of the companies working in the defense industry and using ZWCAD / ZW3D in the world are as follows:

Gameco

Gameco mainly deal with mechanical, electronic and plastic aircraft components which require highly accurate 3D simulation. GAMECO has selected ZW3D because of its high compatibility with 2D CAD and its smooth data communication. With the

reduced number of features needed for creating models, designers can enjoy tighter interoperability when transforming drawings from 2D designs into 3D products with much greater integrity.

https://www.zwsoft.com/testimonials/gameco

Stone Manganese Marine (SMM)

Stone Manganese Marine (SMM) is one of the leading manufacturers of large fixed propellers in the world. SMM has been involved in designing and manufacturing ship propellers for more than 100 years. SMM draws up a list of functionality that is required for the project including surface vectors, intersections, fitting accurate curves through propellers (the curve fitting must be absolutely accurate through all points), extending surfaces and intersecting surfaces. ZW3D offers the functionality required at a fraction of the cost of its competitors.

https://www.zwsoft.com/testimonials/stone-manganese-marine

Jiangnan Shipyard

Jiangnan Shipyard is one of the biggest commercial and military shipyards of China. Aircraft Carriers are also manufactured within the premises. Designers use ZWCAD in their 2D Designs and ZWCAD in their 3D designs.

Ulpower Aero Engines

In 2004, Russel Pescod, partner in ULPower Aero Engines (www.ulpower.com), was working on a helicopter project, and he was having a problem with the current engine because of a lack of power. They decided to design and build their own engine because they could control all the variables. With that decision made, Pescod began looking for a suitable CAD package to be used in designing the new aircraft engine. After much research he selected ZW3D. He says, "We chose ZW3D software for several reasons. One, we're a small company with limited resources, so our choice had to be cost-effective. Two, ZW3D doesn't skimp on performance; it had all the tools we needed, and then some. And finally, ZWSOFT was very supportive of what we planned to do."

https://www.zwsoft.com/testimonials/ulpower-aero-engines

Deltamarin

Deltamarin Poland specializes in consulting, design and engineering ranging from small concept development tasks and studies to complete engineering packages in the marine field. They have chosen ZWCAD to create more efficient and innovative vessel designs for ship owners and yards.

https://www.zwsoft.com/story/mfg/2923

International Defense Industry
Procurement Authorities to Meet at IDEF 21

by Cem Akalın

Due to the novel coronavirus (COVID-19) outbreak, which was officially declared a pandemic on March 11, 2020, almost all international fairs in 2020, and those in the first half of 2021 were canceled or postponed to a later date. Virtual fairs and bilateral meetings held virtually, though not taking the place of physical fairs, prevented a complete cessation of business development and promotion activities during this period. However, we should say that business developers and companies have started to discuss the efficiency of virtual events - location and time independent – which were highly appreciated initially and accepted as a way out, due to the prolongation of the process together with the impact of falling revenues.

During this period where the risk of contamination continues, some country borders are closed, international transportation-logistics as well as travel are problematic, and many international companies predictably thought twice about their participation in a fair at the beginning of the year. Consequently, many giant international companies have suspended all their activities in the first half of 2021 to protect their staff and reduce risk during the continued pandemic. At the beginning of year, Turkey announced that the 15th International Defense and Industry Fair - IDEF'21, which was planned to take place at the TÜYAP Fair and Congress Center in Istanbul Büyükçekmece on May 25-28, 2021, would be held physically as usual. But at that time, at the beginning of May, the number of daily

cases were still quite high in the country and a great number of Turkish companies hoped to delay the event push the exhibition forward. Eventually, the Turkish Armed Forces Foundation announced that the IDEF 2021 15th International Defense Industry Fair was postponed to 17-20 August due to precautions in line with the recommendation of the Ministry of Health Scientific Advisory Board on 5th May.

Up to 5th May, 119 out of 446 foreign delegations who were sent official invitations have already confirmed that they would participate in the fair (In IDEF 2019, 151 delegations and 588 delegation members from 71 countries and 3 international organizations were hosted), and among these high-level officials, there would be 25 ministers. The delegations to participate in the fair include senior officials at the level of Minister, Deputy Minister, Chief of General Staff, Deputy Chief of Staff, Air Forces Commander, Land Forces Commander, Naval Forces Commander, Gendarmerie General Commander, Coast Guard Commander, Director General of Police and Undersecretary as well as a great number of the armament and procurement directors of several countries would be participated in this year's fair in advance of the postponement. On the other hand, more than 1,000 companies from Turkey and abroad are already booked the place in the exhibition.

From the beginning of the year to July, a vast number of developed countries have already attained a mature level of progress in vaccination programs and the transmission of COVID-19 seems to be controlled in particularly Europe and the South American Continent so far. As of 15th June, Turkey ultimately entered the ranks among one of the quickest vaccinated countries list. Up to 1st July, over the 40 million residents have already been vaccinated with at least a single dose and 15 million residents have received both doses. The vaccinated numbers increase daily and Turkey already has now surpassed the capacity to vaccinate 1.5 million per day. It seems that a considerable number of citizens above the age of 18 will be vaccinated with the second dose by 17th August. On the other, all restrictions were lifted as of July 1st all over the countries and normalization progress officially started in Turkey.

TÜYAP Fairs Organization Inc. runs the organization of the International IDEF Fair and in the interview below we talked with Hakan MİRGÜN, Deputy General Manager of TÜYAP Fair and Exhibition Center to gain some insight into the preparations this year and how the team handles numerous complex parameters that are difficult to control. This year will mark the event's 15th anniversary under the management of the Turkish Armed Forces Foundation, and we've asked about expectations, planning and the precautions that are being taken, as well as the perspective of decision makers.

Hakan MİRGÜN: "As of August 9, the official booth setup period will start for our exhibitors"

Defence Turkey: Mr. MİRGÜN, IDEF'21 would have been held between 25-28 May 2021 but, this date was postponed to 17-20 August due to the pandemic, announced just one week before the exhibition. Could you please sum-up the postponement process and new arrangements? Has booth setup started and what can you say about the latest status in terms of preparations for this year's upcoming?

Hakan MİRGÜN: The countdown has begun for IDEF' 21 and all preparations are underway at full speed. All parties, our exhibition center, relevant institutions and participating companies are feverishly preparing for IDEF, the international trade platform of the defense industry.

We expect the fair, which brings together local and foreign industry professionals, and which hosts strong collaborative relationships every year, to be held with the participation of hundreds of companies and we anticipate the visits of many industry professionals this year. In this context, we carry on our effective promotional activities within the country and abroad. We have access to defense industry professionals through the most appropriate channels thanks to our relations with national, local, and sectoral broadcasting organizations. Domestic and foreign sector professionals will gather again at the fair this year to take advantage of our fruitful business networking opportunities.

Five meetings specific to COVID-19 measures have been held so far and have been attended by relevant Ministries and officials. Rules have been updated and have started to be implemented as well. In addition, dozens of meetings have been held with the participation of all relevant institution officials, and all necessary work has been planned and has already started to be implemented for an efficient fair.

Work on our fairground has already begun and our fair center has been reviewed and examined in detail and all necessary arrangements have been initiated. As of August 9, the official booth setup period will start for our exhibitors. To provide an efficient experience for all stakeholders, we are continuing all necessary efforts at full speed for the organization of the fair, which is a sales and marketing platform where our participating companies can deliver their products and services directly to the right buyers. Within the framework of the circumstances that our country has been going through, it is more important than ever to showcase the point at which our defense industry has reached with national and domestic facilities. We are carrying on preparations with this awareness and responsibility.

Defence Turkey: Did the option of holding a virtual fair come up on the agenda due to the COVID-19 pandemic? What kinds of measures have been taken this year for the IDEF'21 Fair?

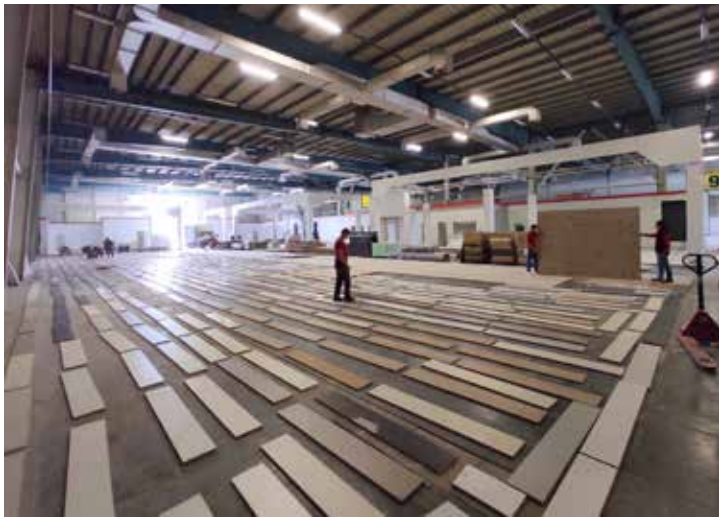
Hakan MİRGÜN: The IDEF'21 Fair will be held physically as with previous fairs, the fair being held virtually or having a virtual part was not on our agenda at any point since we started the preparations. As it is known, the fair is being prepared under the auspices of our Presidency, hosted by our Ministry and under the management of the TAFF. In the dozens of meetings held, there was no mention that the fair could be held virtually, on the contrary, the necessary measures to be taken were discussed and what should be done in order to exhibit, to the entire world, the level of achievement that our defense industry has reached.

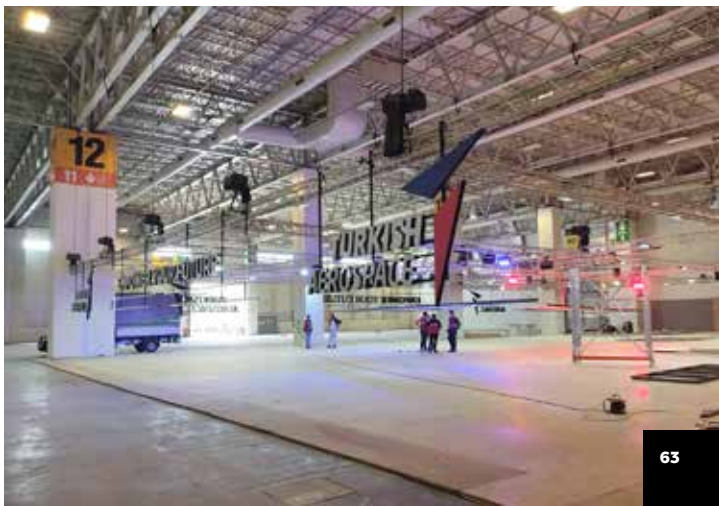
As the TÜYAP Fair and Exhibition Group, we set out with the motto of "Health First for Trade" and we have come a long way in implementing increased hygiene measures. We became the first and only fair organization company that obtained the COVID-19 Safe Service Certificate of the Turkish Standards Institution and we registered all of our practices that we are sensitive to in this regard. We consider it our priority to keep the controls at the highest level for everyone who wants to enter the fairground and to provide a safe fair experience to all our exhibitors and visitors with our entrance system and 2 large checkpoints that we will prepare in accordance with social distancing rules for the IDEF'21 fair. Since September 2020, the TÜYAP Fair and Exhibition Group has held fairs where we have implemented precautions that will set an example for our counterparts across the world, and we continue to do so. Combined with our experience here, all measures continue to be developed in coordination with the relevant authorities. We not only bring our exhibitors and visitors together at the fairground but also bring them together 365 days a year on our digital platforms and prepare an environment for the continuance of trade throughout the year.

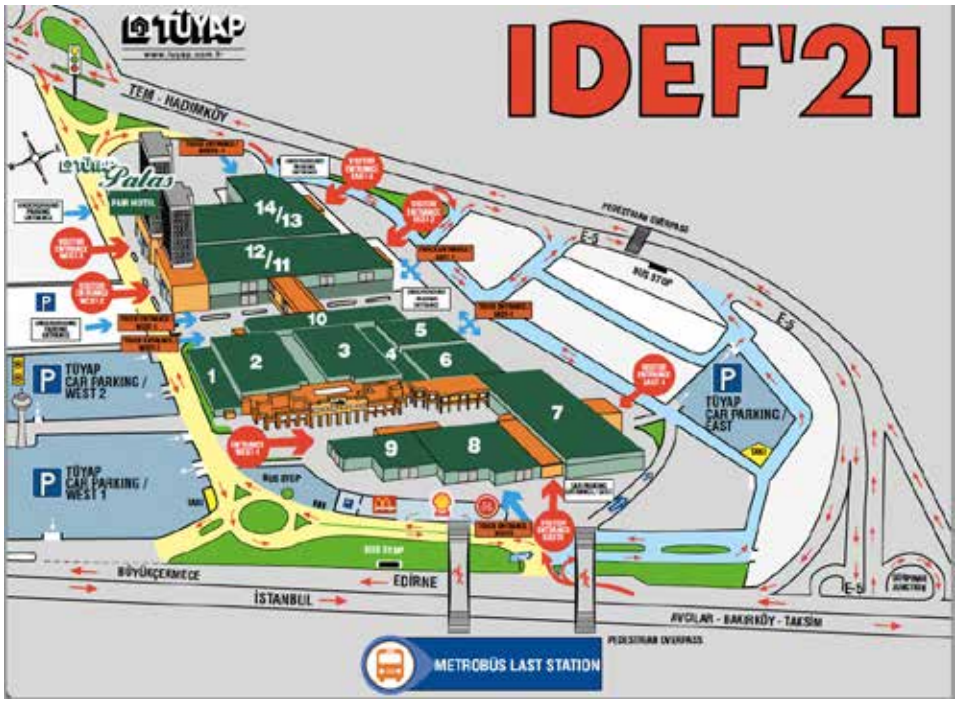
With our MyTüyap app, we have become a pioneer in new generation fair organization. In 2020, we added the Connect platform to our MyTüyap app so that our participating companies are able to meet potential buyers. The smart matching system, which is an example of a successful algorithm that we have been using with Connect for years, enables our participants to meet online with potential buyers.

Hakan MİRGÜN**:** "450 foreign delegations were invited by the Ministry of National Defense, Ministry of Interior and its affiliated organizations, and our Presidency of Defense Industries."

Defence Turkey: What can you say about the level of participation from domestic and foreign companies this year compared to previous years? Could you please share the updated figures? Will there be new company and delegation participation from abroad following the improved rate of vacation in Turkey?







Hakan MİRGÜN: As you know, IDEF is a growing fair, adding new participants to its loyal ones every year. This year, our usual exhibitors will take their places in our fair, and our new exhibitors continue to join as well. There is only a month left for the fair and our sales are about to be finalized. IDEF'21 will be held on a 120,000 m2 exhibition area with the use of our 14 halls. In addition to our indoor areas, the products and services of our participating companies will also be displayed in the outdoor area.

This year, we also opened our 4th hall on our fairground to participants. The participating companies will now exhibit their products and services in this hall as well, which we used as the Interview Offices during previous IDEF fairs. We are also preparing our Interview Offices as in previous years. However, due to and additional hall requirements, resulting from the intense interest of our participants, we have moved these offices to the 1st hall where B2B meetings can be held more efficiently.

Defence Turkey: During the IDEF '19 Fair, over 100 signing ceremonies were held which was a great success. In addition, 151 delegations from 70 countries were hosted at the fair. In this context, what is your anticipation for high level participation compared to previous years and your expectation regarding the export success of this year's fair?

Hakan MİRGÜN: As in previous IDEF fairs, we will host our foreign delegations at our fairground again this year and we will arrange face-to-face meetings by taking all precautions in line with the COVID-19 measures.

As it is known, we host the defense industry procurement authorities of several countries at our fair every year and prepare an environment for international cooperation. This year, 450 foreign delegations were invited by the Ministry of National Defense, Ministry of Interior and its affiliated organizations, and our Presidency of Defense Industries. Confirmation of these invitations started much earlier than the previous fairs and up to date, 116 delegations have confirmed their participation in the fair. These include senior officials at the level of Minister, Deputy Minister, Chief of General Staff, Deputy Chief of Staff, Air Forces Commander, Land Forces Commander, Naval Forces Commander, Gendarmerie General Commander, Coast Guard Commander, Director General of Police and Undersecretary. 26 ministers have confirmed that they would attend the fair. This year, the increasing interest of senior officials responsible for the defense procurement of their countries already signals that IDEF'21 will be quite efficient and will achieve its targets.

As in 2019, this year's meetings are planned on the basis of Participant-Participant, Delegation-Participant, Participant-Turkish Procurement Authority, Delegation-Turkish Procurement Authority and Delegation-Delegation. We have a special team that is focused on organizing the meetings to be held to ensure maximum efficiency during the fair.

Officials from the Ministry of National Defense, Ministry of Interior and its affiliated organizations, General Staff, Service Commands, General Directorate of Security, Gendarmerie General Command, Coast Guard Command, and Presidency of Defense Industries will hold meetings with exhibitors and foreign delegations throughout the fair in the offices we have set up. Signature ceremonies regarding collaborations, one of the key components of IDEF fair, are also planned.

Defence Turkey: Mr. MİRGÜN, thank you for your time and sharing details with us. Along with your team, we look forward to the IDEF Fair this year as it truly contributes to the promotion of Turkey and we wish you success for a fruitful and advantageous event this year

SUPPORTED BY

TÜYAP FAIR CONVENTION AND CONGRESS CENTER
Büyükçekmece, İstanbul / Turkey

THIS FAIR IS ORGANIZED WITH THE AUDIT OF TOBB (THE UNION OF CHAMBERS AND COMMODITY EXCHANGES OF TURKEY) IN ACCORDANCE WITH THE LAW NO.5174.

by Cem DOĞUT

SOLOTURK WELCOMES DEFENCE TURKEY ON ITS 10TH ANNIVERSARY

The SOLOTURK Demo Team is celebrating its 10th anniversary with several events throughout the year. It has been ten years since the first flight was made in the 100th year of the Air Force Command. For ten years, there have been hundreds of flights, many memories, and changing teams, but the only thing that doesn't change is that SOLOTURK shines bright like a star in the sky. 10-year anniversaries have always been special. It is a significantly important step towards permanence.

We, as the Defence Turkey team, would like to give you some more details about SOLOTURK's rise over the last 10 years, to better inform our readers.

With the special permission obtained from the Ministry of National Defense, we visited the SOLOTURK team at their home, the 132nd Weapons and Tactics Squadron Command of the 3rd Main Jet Base Command in Konya. We asked the SOLOTURK team about everything that you have wanted know about them. Of course, we also had the opportunity to closely view the special paint changes made on the aircraft for the 10th anniversary, and we got some great shots. But first let's take a moment to look back to the past... How did this story begin?

The "Demonstration Flight with a Solo F-16 Aircraft" program, initiated by the Air Force Command on November 25, 2009, was put into practice with the selection of the constituting team on January 14, 2010. The name SOLOTURK was chosen among more than 300 names suggested by Air Force personnel.

© Özkan ÜNER

On the 100th anniversary of the Turkish Air Force Command (TurAF), SOLOTURK was first introduced on April 15, 2011, and this date is also accepted as the establishment date of the SOLOTÜRK team. The team made its first show open to the public in Samsun on May 19, 2011, as part of the Commemoration of Atatürk, Youth and Sports Day events. Initially, an F-16C Block 40 tail number 91-0011 was used as the main demonstration aircraft, and an F-16C Block 40 aircraft, tail number 90-0011 was the backup.

There is an eagle motif on the wing and tail of the aircraft, representing the Turkish Air Force. Under the body, there is a crescent star motif representing our country. No modifications were made on the aircraft, except for the graphic design and the smoke devices on the edges of both wings. In this way, these aircraft can also join combat missions when necessary. One of the most important features that distinguish SOLOTURK pilots from other demonstration pilots is that they are still combat-ready pilots. Aside from demonstration flights, they continue to assume combat missions. Another distinctive feature is the demonstration flight training.

SOLOTURK Demo Team describes itself as follows:

"*Other solo teams around the world often receive training from previously established teams (the U.S.) at the foundation phase, and as a result their performances are based on typical choreography. SOLOTURK Pilots, on the other hand, prepared a unique choreography by benefiting from the centuries-old experience of the Air Force and its pilots with advanced training level, without any support from any country. Each year, new choreographies are added to this performance, and a show specific to that year is planned.*"

Of course, to become a SOLOTURK Pilot, one needs to endure a challenging process. To execute a performance that is difficult to describe even on paper and to realize the untested in the sky by blending it with experience is tough and challenging. Following the four-year undergraduate education at the Air Force Academy, they receive flight training at the 2nd Main Jet Base Command in Çiğli/İzmir. Afterward, the pilots who receive the Combat Readiness Training become the 2 and 4 ship formation leaders in the squadrons they are assigned to. This is, in fact, a standard procedure to become a pilot in the Turkish Air Force. After 1,000 hours of flight in the F-16, they are eligible to become SOLOTURK Pilot candidates on a voluntary basis. Under normal conditions, the duty period of the demonstration pilot and SOLOTURK Wing Commander is two years. In the second year of the 1st Demonstration Pilot duty, the candidate pilots selected by the Air Force Command among the F-16 pilots who meet the above criteria begin to receive training from the 1st Demonstration Pilot. Following training, the pilot takes part in the team as the 2nd Demonstration Pilot. In this training, the candidate pilot in the two-seat F-16D aircraft fulfills all the performances in the SOLOTURK demonstration package in the airfield under the leadership of the instructor demonstration pilot. The training of the candidate pilot, who has mastered all the performances, continues with training over the sea. In addition to the Demonstration Pilot training, the flight safety observer training (every demonstration pilot must take this training), which is the duty of the other demonstration pilot on the ground during the demonstration, is also received at this stage.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A Flawless Flight is Possible with a Distinguished Team

We should also mention the technical maintenance team working seamlessly in the background supporting the show. With great dedication the teams behind the scenes are essential for the demonstration pilots so that they can perform their choreographies flawlessly and the aircraft can be ready at any time. The team that maintains the F-16s and always keeps them ready for duty is an inseparable part of SOLOTURK. The maintenance team consists of a total of 9 personnel, including 1 Maintenance Officer and 3 Jet Mechanical Technicians, 1 Jet Engine Technician, 1 Aircraft Fuel Systems Technician, 1 Aircraft Weapon Systems Technician, 1 Aircraft Electrical and Air Conditioning Technician, and 1 Avionics Systems Technician. Those who do not know aviation may only consider it as the plane and pilot, but in fact, aviation is grounded in great teamwork. For a 20-minute show, the maintenance team carries out a total of 6 hours of maintenance activities, 3 hours pre-flight and 3 hours post-flight. During such maintenance activities, 251 different points over the aircraft are checked in detail. The forces that the aircraft is exposed to during a demonstration flight, at low altitude, high speed, and high G-forces, are quite different from those during typical mission flights. This directly affects the maintenance activities. The maintenance team always keeps the aircraft flight ready by combining their knowledge and experience with devotion and precision.

Another part of the pillar is the press and public relations team. The primary task of the team, which consists of a Press and Public Relations Officer and a Press and Public Relations Petty Officer, is to carry out promotional and coordination activities of the show.


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Well, what can we do if we want to invite the team and watch the SOLOTURK show in our city? The best method to get started is to submit a request to the Governor's Office in the province of residence. The team pays special attention not to hold demonstrations in the same place for two consecutive years and puts on shows according to important days and weeks. The team explains how the show schedule is set as follows:

"In order to set the SOLOTURK demonstration schedule, requests are collected from all provincial governorships for the next year's demonstrations with the coordination of the Ministry of National Defense (MoND) and the Ministry of Interior. Governorships submit the requests collected from municipalities, schools, and other institutions to the Ministry of Interior. All such applications are collected and then forwarded to the Ministry of National Defense. The draft show schedule is set with the evaluation of the applications by the Air Force and SOLOTURK team and the approval of the Force Command. This draft is submitted to the Chief of General Staff and the Ministry of National Defense, respectively. Upon the necessary changes, the next year's show schedule is set. Following the finalization of the show schedule, the Governorship of the Province where the show will take place is informed. Then the show venue is selected as per the examination of the pilots to ensure flight safety. As the show date gets closer, plans are made for the necessary infrastructures (stage, tribune, sound system, etc.) that will be set up at the venue. Then the demonstration flight show is announced to the public both on social media and in particular via local media. The maintenance team and the press and public relations team are transferred together with all the necessary materials by transport aircraft to the most convenient airport close to the venue where the show will be held. When choosing the airfield, primarily military airfields are preferred due to logistical convenience, but civil airports can also be used. Both demonstration pilots, together with the main and backup aircraft, are transferred to the relevant airfield after the maintenance team. In the meantime, a surrounding check flight is conducted above the demonstration venue. Obstacles around the show venue, directions of approach to the airfield, and what to do in an emergency are determined through this flight. The press and public relations officer and the flight safety officer arrive at the show venue two days before the show and flight readiness review is conducted on site, and then the demonstration aircraft arrives at the airfield for rehearsal."

The SOLOTURK Demonstration Team works for hours on details, ranging from choreography to be performed, to weather conditions, from flight safety to the coordination of the whole team, in preparation and putting the final checks on all checklist boxes.

"The shows consist of two different packages determined according to weather conditions. These are the low and high packages. The high package consists of 21, and the low package consists of 19 breathtaking maneuvers. Some of these are signature maneuvers specific to SOLOTURK. Different maneuvers in different seasons are included or removed from

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these packages within limits allowed by the aircraft. The cloud base determines the package selection. When the Demo Pilot arrives at the show venue, they check the cloud base height before making their first maneuver and decides which package to choose. The pilot informs the flight safety observer about this. The demonstration package is rehearsed by the flight safety officer's direction from the ground. During this rehearsal, the information regarding the surrounding obstacles, the altitude, direction of the maneuvers, maneuvers where flares are fired (Flare is a high-temperature heat source ejected from aircraft that mislead heat-sensitive or heat-seeking missiles. It is used during shows due to its visual effect.) is transferred to the demonstration pilot with the inputs of the flight safety officer. After the rehearsal, while the aircraft leaves the venue, the press and public relations officer and the flight safety officer stay in the venue and continue the preparations for the show by providing coordination

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with the organization that organizes the show. On the day of the show, at least two hours pre-flight, the press and public relations officer, as well as the flight safety officer, initiate the related activities at the show venue. After determining that all preparations are completed, and there is no obstacle for the flight, they give authorization to the demonstration pilot. Before and during the demonstration, the press and public relations officer informs the public about the demonstration and the purpose of the event. One of the most difficult parts of this task is the narration made in the language of the country where the show is held. It is a challenging process to rehearse the prepared text for days and to pronounce it correctly, but these challenges are appreciated and tolerated with a smile and good reactions received in the related country. The first-rate promotion of our country and the Turkish Air Force is accomplished in the best way."

The entire dedicated team spends long hours in the static area next to the aircraft to observe how the crowds react to the demonstration and to communicate more closely with the public. (Unfortunately, this activity has been temporarily canceled during the pandemic process due to social distancing rules.) This period is reserved for activities such as one-to-one chats and photo shoots. The next day, with the pleasure and pride of performing the show successfully, the team is transferred back to their home, to the 3rd Main Jet Base in Konya.


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15 Countries, over 60 Cities, and more than 200 Performances in Ten Years

SOLOTURK has performed more than 200 shows since its establishment. So far, 60 such shows have been held abroad in 15 countries, and the remaining have taken place at over 60 destinations in Turkey. Among these, there are big international organizations such as the Istanbul Air Show, Teknofest, Formula-1, and IDEF. The SOLOTURK Performance Team has received various awards for its international performances. The most prominent of them are as follows:

- The "Best Flying Display" award among 29 show teams at the Royal International Air Tattoo – RIAT held in England in 2011
- The "Best Outdoor Design" award given by the Graphic Designers Professional Organization in 2012 for the paint of SOLOTURK aircraft
- The "Best Demonstration Flight" award at Slovak International Air Fest – SIAF held in Slovakia in 2017
- The "Best Solo Jet Demonstration Flight" award at the Royal International Air Tattoo – RIAT held in England in 2018

As it can be seen, in the first year of its establishment, the SOLOTURK Demonstration Team participated in the Royal International Air Tattoo, one of the most important air shows in the world and received an award.

The team, which has further developed its corporate identity with the experience it has gained over the last ten years, achieved success in having become a well-known and reputable brand among solo show teams both in our country and in the world. Watching the SOLOTURK's show is very impressive and has an unforgettable effect that lasts a lifetime, even for those not interested in aviation. The skills of our demonstration pilots, the incredible maneuverability of the F-16 aircraft, the tremendous sound of the F110 engine, and of course, the visual effects of the flares during the show come to the fore in this success.

While our SOLOTURK pilots, the shining stars of the Turkish Air Force for a decade, exhibit their know-how, experience, and skills to the audience with their choreography, the maintenance and public relations teams also demonstrate the professionalism of our army to the public. The SOLOTURK Demonstration Team instills a passion for aviation in tens of thousands of youngsters, the boys and girls who look skyward and dream of being in their place one day. Through demonstrations and public relations activities on the ground, and by setting an example for youngsters across the globe who are ready to pursue their passion, the SOLOTURK Team will continue to make us proud, representing our country at the highest level in the world.

Happy 10th Anniversary to the SOLOTURK Performance Team! They certainly have come a long way in a short period of time!


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ITPS Expertise Spans World of Aerospace Domains

One of the world's most remarkable aerospace success stories takes place in London, Canada, where ITPS Canada sets the standard in quality, bespoke training for test pilots, flight test engineers and tactical leaders. Originating in Cranfield, UK and for the past twenty years is headquartered in London, Ontario, Canada. ITPS is a unique organization with two divisions, offering the highest qualifications achievable by military pilots training to be Experimental Test Pilots at the International Test Pilots School and Fighter Weapons Instructors at the International Tactical Training Center (ITTC). One of only four fully accredited schools of flight testing worldwide and the only commercial military tactical training center, ITPS is staffed by world-class experts and driven by passion. ITPS is a leader in aerospace training innovation.

ITPS uniquely focuses on bringing its expertise to solve specific customer requirements. Whilst providing internationally accredited programs, ITPS strives to make each program relevant and valuable to an individual customer, be it an Experimental Test Pilot Course focused on 5th generation aircraft flight testing or a shorter EASA CAT-2 compliant course focused on military tactical transport with additional military systems modules. Effective and affordable stop-gap solutions are delivered, including Fighter Lead-In Training (FLIT) and Fighter Weapons Instructor Courses (FWIC). In addition, as an Ontario Ministry of Education Designated Learning Institution, ITPS is able to offer a Master of Science in Flight Test Engineering to international students either as part of the one-year test pilot and flight test engineer courses or as a stand-alone program. This is a fully accredited post-graduate degree under the Ontario Ministry of Education, enjoying the same international recognition as all Canadian University degrees.

Despite the pandemic, ITPS continues to attract students from industry and military worldwide and is busier than ever, thanks to great support from the Canadian Government in facilitating access to international students under an Essential Services provision. Classes in 2021 include students from the Royal Canadian Air Force, Royal Australian Navy, Republic of Korea Air Force, Royal Thai Air Force, Royal Malaysian Air Force and Belgian Defense. Major manufacturers are also attending ITPS with students from Airbus Manching and Leonardo Helicopter. Both the latter have entrusted ITPS with multi-year contracts to educate their flight test engineers and, in the case of Airbus, also Experimental Test Pilots. Feedback from customers highlights the excellence of the instruction, outstanding facilities, the unique fleet of aircraft and simulators and the supportive and collegial atmosphere at ITPS.

Both Turkish industry and military have been long-time partners of ITPS in this context. ITPS is proud of the fact that every single Experimental Test Pilot and almost all qualified Flight Test Engineers in Turkey are ITPS graduates. As early as 2013, ITPS delivered bespoke training for the Turkish Aerospace flight test team for the HürKuş turboprop trainer, experimental test pilot and flight test engineer training for TÜBITAK-SAGE and multiple in-country courses for Turkish Aerospace Industries (TUSAŞ), Aselsan and Roketsan. In recognition of this special relationship, ITPS sponsored the training of a Turkish Air Force Experimental Test Pilot on a one-year course in 2019. ITPS looks forward to its continued collaboration with Turkish industry and the Turkish Air Force,

The pandemic has had a silver lining in that it has spurred innovation and, in November 2020, ITPS introduced a Part-Distance Learning Graduate Test Pilot and Flight Test Engineer Course with launch customer the Commercial Aircraft Corporation of China. Students in Shanghai attended a ten-week, 400 lecture hour ground school, with live support by ITPS instructors. Pandemic restrictions resulted in the practical elements of the course being conducted in Shanghai and Chengdu with the course completing in October 2021 with a final project on the ARJ-21 at COMAC in Shanghai. ITPS's responsiveness and flexibility were highlighted by this challenging program for a major aircraft manufacturer while under great pressure to qualify flight test crews for its airliner programs.

ITPS prides itself in not only teaching, but actively participating in flight testing and tactical operations. In 2020-21, ITPS teams supported the certification flight tests for the Harbin Aircraft Industries Group AC352 and CHANGHE AC311 helicopters in China. ITPS was also contracted to provide support for the Natural Icing Flight Test Campaign of the COMAC C-919 airliner. At the time of writing, an ITPS team of instructors was flying in Thailand with the Royal Thai Air Force honing the skills of the RTAF TOP GUNs on the 2021 Fighter Weapons Instructor Course. The synergy between tactical and flight test training operations enhances all ITPS training programs, keeping instructor knowledge and skills sharp and up to date. This is another factor that enriches the student experience at ITPS.

Top Gun Tactical Training

ITTC, the thriving tactical division of ITPS, is equally responsive and innovative. Presented with a request for advanced training for tactical transport crews, ITTC brought its expertise to bear to develop a new program for Indonesia within 30 days. In July, ITTC will deliver the bespoke Advanced Airlift Tactical Training Course (AATTC) onsite at the customer's operating base. Providing comprehensive tactical training education, including Fighter Lead-In Training (FLIT) and Fighter Weapons Instructor Training (FWIC), ITTC employs a team of world-class experts to develop advanced curricula. As a commercial organization, ITTC has the flexibility to deliver the training on-demand, in Canada or the customer's country. Brendan Pierce, Deputy Head of Training, says, "our expert instructors develop a recommended syllabus based on thousands of hours of tactical experience. That syllabus is then tweaked in consultation with the customer to maximize its training benefit in accordance with their specific needs."

Ground, and In-Flight Simulation

Advanced simulation, including Virtual Reality (VR) and Mixed Reality (MR), revolutionized flight training and ITPS was an early adopter of these technologies. ITPS has invested in a world-class facility to implement modern training curricula leveraging the latest technology. The Advanced Aircraft Simulation Centre (AASC) comprises four F-18 domed simulators, four F-35 pilot stations, a Boeing 787 full flight deck FBW simulator and an F-16 based Variability Stability System (VSS) engineering simulator. The AASC also contains a mission briefing room and a large lecture theatre for unpacking missions in a collaborative classroom style. Simulators are networked and within a synthetic battlespace, complex missions may be flown with real time ACMI (Air Combat Maneuvering Instrumentation) for monitoring the progress of exercise and post-mission debriefing. Live Virtual Constructive Training (LCVT) allows for very realistic and effective tactics training in complex scenario at low cost.

The simulator training includes virtual reality using VR 360° headsets

Students debrief using ACMI

Four F-18 dome simulators in the Advanced Aircraft Simulation Centre

with a resolution synthetic image. Thus, students learn in a photorealistic immersive environment with extraordinary realism. The variety of available technologies allows ITPS to optimize the training to make use of the most advantageous devices.

For example, on request of the Republic of Korea Air Force, an aerial refueling flight test course was developed using the simulators. It proved possible to teach both the drogue and boom tanker systems test methods and provide a program not available at any other institution. The AASC capabilities have only begun to be utilized and multiple on-demand courses have already been developed including an Advanced Weapons and Tactics (AWT) course, a Joint Terminal Attack Controller (JTAC) course and others.

Continuous Technology Innovation

A major challenge facing air forces involves training pilots for 5th and 6th generation fighters. ITPS is training such candidates right now with graduates going on to test F-35, KAI KF-21, and starting next year, candidates for the

The first female ROKAF student in an F-35 simulator.

Turkish Aircraft Industries TF-X. Operating costs of these new aircraft are extremely high and asset numbers limited, making simulation an essential tool in preparing tactical and flight test crews. ITPS is leveraging in-flight simulation with its 5th Generation Surrogate Training Aircraft (5STA) Project. The key concept is that if one cannot afford to train in a 5th generation fighter the next best thing is to put elements of 5th generation concepts, avionics and simulated systems in an affordable and maintainable platform.

The resulting 5STA is a novel learning tool: A Hawker Hunter T-75 with a Genesys Systems-based cockpit upgrade. The 5STA features an L3 PanthrTM Large Area Display (LAD), Embedded Tactical Simulation System for both Air to Air and Air to Ground missions, Hands-on Throttle and Stick (HOTAS) controls and a Thales Scorpion Head Mounted Display (HMD). This asset is entering ground testing and once cleared for training operations in early 2022, will provide students with the opportunity to learn about operating or testing current and future fighter aircraft featuring advanced Human Machine Interface (HMI) concepts.

Remotely Piloted Aircraft Systems (RPAS) are proliferating in service and in roles and are increasingly capable and complex. This has led to a demand for training in RPAS employment as well as Test and Evaluation. The challenge for ITPS was to bring into service a representative system which provided excellent training to customers but at an affordable cost and without security restrictions. The answer is the Manned Remotely Piloted Aircraft (MRPA), an advanced, one-of-a-kind, operational RPA able to fly complete Medium Altitude Long Endurance (MALE) missions, carrying a state-of-the-art EO/IR/Laser turret sensor. The MRPA Ground Control System trailer (GCS) is fully representative of systems in service. In addition, it can also operate in simulation mode for greater operational flexibility and functionality, such as weapons delivery and Large Force Employment (LFE) networked into our Advanced Aircraft Simulation Center (AASC).

The MRPA can legally fly beyond the line of sight in civil airspace, providing great flexibility of operations.

An essential skill for test pilots and flight test engineers is the evaluation of Handling Qualities, particularly in the context of highly augmented aircraft, equipped with Digital Flight Control Systems (DFCS). Purchasing and operating a DFCS equipped aircraft would be too costly and would be extremely restrictive. The school therefore started developing an Adaptive Handling Qualities Aircraft (AHQA) Variable Stability System (VSS) aircraft tool in August 2020. This VSS allows for a dynamic environment where the aircraft's handling qualities are modified to enable different aircraft flying qualities to be demonstrated and tested in flight. The system is a valuable tool to validate novel controls laws and aircraft response. The AHQA is already in ground testing before the first test campaign this summer.

5th Gen. Surrogate Training Aircraft (5STA).

A diverse fleet of aircraft

The diversity of aircraft available for training at ITPS is second to none. The school owns over 22 fixed- and rotary-wing aircraft that occupy the ITPS hangars, including three Hunter T-7/75, five Aero Vodochody L39C, three Aero Vodochody L29 Delfin, a Beechcraft B60 Duke, a Cirrus SR-22 and an IAR 823 Brasov.

The school uses three helicopters on the rotary-wing side: A Bell 206B Jet Ranger, a Sikorsky S-76 and an MBB Bo 105M. Additional aircraft are leased by the school, including an Embraer Phenom 100 and 300, a Pilatus PC-12 and an Agusta Westland AW109SP as well as a variety of ex-military aircraft.

A unique asset is the Grumman HU-16 Albatross seaplane. Ever popular with students and staff, this vintage aircraft provides a challenging transport aircraft learning experience for students, with the added capability of operations off the surrounding Great Lakes!

A Flexible Approach to Program Delivery

Uniquely for organizations in this sector, ITPS is singularly focused on meeting the requirements of each customer, rather than requiring customers attend a "one-size-fits-all" program. Whilst addressing all the foundational knowledge, training is optimized by exposing students to different aircraft or systems of particular relevance to their future career. Course modules can be drawn up on demand as was done recently with the Air-to-Air Refueling Flight Test (AARF) and the Cybersecurity Test and Evaluation modules.

Adaptive Handling Qualities Aircraft – a new challenge for flight test professionals.

Training is available online for distance learning either as short courses or in preparation for the flying phase in Canada. ITPS prides itself on its responsiveness, and customer focus.

Manned Remotely Piloted Aircraft (MRPA).

Looking Ahead on the Horizon

ITPS exists to provide the highest level of training, best quality on demand to customer specification. Customer feedback indicates that ITPS in this approach has a winning strategy – Going forward we shall redouble efforts to provide customers with the best learning experience, whilst embracing and introducing new technology and investing in world class expertise. The future is bright for the International Test Pilots School

Impressive fleet at ITPS

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The S-80 PLUS Submarine Program

The Spanish shipyard Navantia launched the first S-80 Plus submarine S-81 Isaac Peral on 23 April 2021.

The boat is named after the Spanish Navy Lieutenant Isaac Peral y Caballero, in honor of the scientist and sailor who invented a submarine capable of launching torpedoes in 1888.

The second submarine S-82 Narciso Monturiol will be delivered in in June 2024. The deliveries for the third and fourth submarines are scheduled for April 2026 and August 2027.

The submarine is currently undergoing factory and harbor trials by Navantia. The sea trials will begin in the first quarter of 2022. The Scheduled delivery of the submarine to the Spanish Navy is in 2023.

The S-80 Plus submarines have submerged displacement of 2,965 tons. The boats are 81 meters long. Their pressure hull diameter is 7.3 meters. Their draught is 6.3 meters. The hull of the submarine is optimized for very low acoustical signature. They have a single hull with several watertight layers/ surfaces.

With a crew of 32 submarines the boats have spare berthing for 8 special forces personnel. The boats have an endurance of 50 days operation away from the port.

The main propulsion is a 3,500kW electric motor. There are three 1,200 kW diesel generators that produce the power needed by the electric motor.

The S-80 Plus class submarines will have an air independent propulsion system developed in Spain. However, this AIP system based on an ethanol reformer and PEM fuel cells will be ready only for the third boat.

When finished the AIP system will have two components, the PEM and the bioethanol processor. The 300Kw fuel cell power module, supplied by the American company UTC Aerospace, will generate electricity by a chemical reaction from the mixture of pure oxygen in a gaseous state and pure hydrogen. The S-80 Plus has a hydrogen production system on board as reformed bioethanol. The Spanish Ministry of Defense (MoD) decided to go with bioethanol instead of ethanol as bioethanol can be produce in country thus eliminating the dependence on international ethanol production.

by Cem Devrim YAYLALI

This bio reformer ensures enough hydrogen for the submarine to remain underwater for fifteen days.

The first two boats will be delivered without the AIP system. This system will be Retro fitted to the first pair during their mid-life upgrade.

The submarine has 2 battery compartments with each carrying 180 elements.

The Spanish Navy considers, like any other navy, its submarines as capital ships. The submarine's ability of discretion and invisibility make them strategic assets. They will fulfill traditional

submarine missions such as attacking enemy naval or merchant ships, laying offensive mine fields, gathering information about enemy vessels, sensors or movements. Furthermore, the S-80 Plus submarines will present the Armada with something unprecedented in their current submarines: firing missiles such as the UGM-84 Harpoon for surface vessels and BGM-109 Tomahawk cruise missiles for land attack when Spain acquires this capability.

Additionally, these submarines will operate as part of a naval task force and protect it and its capital ships against enemy submarines and other underwater threats.

The ability, firing missiles underwater is not the only novelty these boats present to the Armada, S-80 Plus class submarines have an integrated combat system. This integrated combat system was developed by Lockheed Martin and Navantia Sistemas. It compromises seven multi function operator consoles, one large tactical display, two navigation and network system cabinets, two weapon processor units, six weapon interface units one sonar array suite and one own noise monitoring system.

The CMS has in its core the SCOMBA system developed by Navantia and used in all Spanish Navy ships starting with the F-105 ESPS Cristobal Colon. Thanks to this common architecture the Armada has had a single combat system for all its ships for years, including the S-80 Plus submarines.


© Navantia

The ICSC allows the combat system's weapons and sensors to be highly integrated to ensure optimal management of both information about operations and the Command-and-Control center. It enables all the necessary information to be gathered, assessed and displayed for offensive, defensive or intelligence actions that can take place at any time. This includes using weapons and countermeasures and their launching devices.

Thanks to this, the combat system is able to find and track multiple targets in different scenarios and simultaneously manage several components.

Specifically, it can manage short, medium and long range active and passive sonars for exploration, attack and navigation tasks; electronic, optronic and electromagnetic detection systems for combat missions or intelligence operations; precise navigation aids; integrated communication systems, including satellite links and tactical data links with other naval vessels through 'Link-11' and 'Link-22', and weapons systems for operations at sea.

The S-80 Plus boats have six 533mm torpedo tubes. The main offensive weapon of the submarine will be the Atlas Electronic made DM2A4 torpedo. This fiber cable guided weapon can be used against both surface and submerged targets, and it has a 50km range and is capable of traveling at speeds of more than 50 knots.


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The combat management system on board can control various stages of the DM2A4 heavyweight torpedo (HWT) such as pre-launch, launch and post-launch. The combat management system also allows this weapon to be fired in different types of launches: deliberate, volley (up to six torpedoes), emergency, urgent and 'jettison'.

As mentioned before, S-80 Plus class submarines will also deploy the UGM-84 Harpoon missile. This is an encapsulated version of the successful Harpoon missiles used by surface ships. The Advance Harpoon Weapon Control System is integrated to the combat management system of these boats. This provides missile control and launch guidance, the 'Block 1', '1B', '1C', '1G', 'Block II' versions and future compatible versions of the 'Harpoon' missile. The submarine is expected to use the 'Block II' version.

Currently the Spanish Armada does not operate Tomahawk UGM-109E Block IV All-Up-Round missiles. This is the encapsulated version of the Tomahawk Land Attack Missile (TLAM). However, all systems on board are designed and the vessel's design includes enough volume and weight for TLAM missiles and the TLAM missile launch guidance equipment. So, when Spain acquires these missiles, they will be integrated into these submarines without any problems or delays.

The launching of the first S-80 Plus submarine was an important milestone for the whole project, which started in 2004 and which faced many uncertainties and possible cancelations.

The Spanish Navy was a good customer of French submarines. In the 60's Spain produced the DCN designed Daphné class submarines for its navy. And later when these submarines become obsolete the Agosta class submarines in the late 70's. They were constructed in Spain with local industrial input according to French designs. This close cooperation between two shipyards led to the creation of the Scorpène Consortium in 1992.

The Scorpène Consortium finalized its first order in 1997 from Chile. Soon two more submarines were ordered from Malaysia. Several Spanish companies were involved in the production of these submarines. Navantia was producing the stern of the submarines, the most complex part.

So, the Spanish Navy had the experience of operating French designed submarines and the Spanish ship building industry was deeply involved in Scorpène production led by France. Therefore, the selection of these, as the next generation submarines in the Spanish Navy seemed to be the most logical and obvious decision.

The Spanish authorities including the Ministry of Defense, the Navy high command and the leaders of the industry decided not to follow the most obvious and technologically safe path and decided to go on with a local submarine design, the S-80 as it was known then, for their own reasons.

This decision turned out to be a very brave one. Perhaps due to naivety or arrogance or overconfidence in their own capabilities or a combination of all of these, the decision makers did not take the technical challenges into account. This overconfidence was punished with the challenges of long delays and increased costs. The

project was on the verge of cancelation, and only through improvisation, rethinking of each step to be taken and discarding immature technologies the project was able to move forward. These efforts to keep the project afloat cost almost a decade. When ordered in 2004 first submarine was scheduled for delivery in 2013, the second in 2014, the third in 2015 and the last in 2016.

The S-80A construction project is without any doubt one of the greatest industrial and technological challenges ever faced by the Spanish national defense industry. Designing a vessel of this kind is a complex and highly specialized engineering task that spotlights the technological capabilities of a country's naval industry as well as its short comings. According to Navantia, it has learned the following lessons from the problems it has encountered during the project: developing a technical doctrine, improving resources, implementing a new, systems engineering model, transforming organization, digitizing, cataloging and validating materials and equipment.

When the S-80 program was approved, an initial budget of 2,14 billion euros was established to be paid between 2002 and 2023, the amount being advanced by the Ministry of Industry. More recently, the government was forced to increase the spending ceiling to 3,9 billion euros, which has so far left the unit cost at 976.5 million euros per ship.

One of the most challenging technical features of the S-80 Plus submarine, the Spanish designed AIP system, is still not ready and will only be implemented to the vessels in 2026 or later.

While the system creates an independence from foreign ethanol producers and gives a strategic autonomy to Spain, the novel AIP approach proved to be too difficult to complete during the projected time plan of the submarine construction program.

These boats acquired a notorious reputation for being 70 to 100 tons too heavy at one stage of the design process. The US submarine constructor General Dynamics Electric Boat was involved in the project as consultants to make the submarines buoyant again.

All stakeholders in the S-80 Plus project persevered through all problems and finally resulted in the first submarine. The Spanish S-80A project carries many valuable lessons for any nation set to design and construct its own submarines. These lessons should be examined very carefully. Smart people learn from their mistakes, wise people learn from other's mistakes

“There Are Many Similarities Between the MILDEN and S-80 Submarines”

© Navantia

In this issue we present you an exclusive interview with Mr. Agustín BLANCO, S-80 Submarine Project Manager, Navantia on S-80 Plus Submarine Project and Navantia's approach to Turkish Navy's MILDEN Program.

Defence Turkey: How would you best describe the state-owned Spanish naval shipbuilder Navantia today? Even though its main line of activity is in the naval field, Navantia also designs and manufactures systems for the Army and the Air Force. Could you please provide some key facts about the company for our readers?

Agustín BLANCO: Navantia is a Spanish state-owned naval shipbuilding company that provides the industrial and technological response to the National Defense and Security forces, by providing its essential naval capability. The company has its own technological capacity to deliver solutions end to end, in the shipbuilding and in the Systems domain, to the Ministry of Defense.

Navantia has an international projection offering global solutions to clients and partners around the world, reinforcing the Spanish Brand and boosting Spanish exports and direct foreign investment. Its presence stands out in countries such as Australia, Norway, Saudi Arabia, Turkey and India, among others.

The close relationship with a crucial customer like the Spanish Navy and the Ministry of Defense has allowed us to build excellent products like the F-100 & F-110 frigates, the Juan Carlos I LHD, or the S-80 Submarine. All of them leading to a great impact into the international market.

Navantia has vast experience as a transfer of technology (ToT) partner having proved its value in a myriad of industrial scenarios. Our experience as a main contractor and systems integrator provides a clear advantage to our partners, land forces and other defense institutions around the world.

Focused on innovation, Navantia invests increasingly in R&D projects, the basis for products and more efficient, competitive, and exportable services. Navantia is going through a digital transformation that includes not only products and services, but also processes and people. This is the deepest challenge the company has ever gone through.

In addition, Navantia has an important social role, generating a great growth and job creation in the regions where it operates, providing jobs of high quality and technological sophistication.

Defence Turkey: Focusing on Turkey now, can you elaborate on Navantia's approach to Turkish Navy's MILDEN (short for Milli Denizaltı, which translates to 'National Submarine') Program? Expected to have an overall length of between 70m to 80m and submerge displacement of between 2.500t – 3.000t, MILDEN submarines are planned to be powered by an indigenously developed hybrid propulsion system composing 6 PEM Fuel Cell Modules (able to generate 300kW+ power in total), a Methanol Reformer System and Lithium-Ion Battery (LIB) sets.

Mr. Agustín BLANCO, S-80 Submarine Project Manager of Navantia

Agustín BLANCO: The Turkish Defense Industry has greatly increased its capabilities in the last twenty years. The country, through SSB Industries, has carried out an admirable effort developing local projects that can now be exported and compete in a global market. There are similarities between Turkey's defense industry and Navantia's recent history. Navantia started building ships and submarines following foreign designs, then the company acquired enough knowledge to design its own surface ships, and succeeded in developing the F-100 frigate, that now has a sister vessel serving in three different navies. We now wish to reproduce the successful experience we had with surface vessels with our own submarine, the S-80. The Program was born out of our experience in submarine shipbuilding and our strong engineering background. But even with more than 20 years building submarines, we faced challenges in the early stages of

the S-80 Program. We had to introduce some modifications to the original plan and make a revision of the schedule. Beginnings always require an effort, especially when it comes to prototypes and even more so in the case of submarines, the most sophisticated vessel.

Defence Turkey: How would you assess the current level of cooperation between the Navantia and Turkish Industry? Do you believe Navantia and Turkish Naval Industry can establish cooperation, at least at Technologic Support Provider (TSP) level, under MILDEN Program?

Agustín BLANCO: There seems to be many similarities between the MILDEN and S-80 Submarines. Not only in the specifications of the vessel (similar size, capabilities, and propulsion system) but also in the Program itself. A very ambitious and powerful program, with a high level of risk, being the MILDEN the first submarine design and built in Turkey. Navantia has walked this path before and, thus, we are in a good position to offer our expertise to assist in the MILDEN Program, to help and avoid those difficulties we hit when we began the construction of the S-80. At the end, a delay in a Program means cost overruns and delays that will not allow the unit to be in service for the country in the expected schedule.

Defence Turkey: Would you like to add anything as a message to our readers?

NAVANTIA: After being present in Turkey for almost 10 years, and working side by side with Turkish companies, Navantia is in a position to assist the Turkish Navy and the Turkish Defense Industry and, what is more important, it can be done locally due to the to the existence of Navantia Turkey.

On the other hand, Navantia appreciates the outstanding products developed by the Turkish Defense Industry in recent years. In the future, the company wishes to increase Turkish equipment and components in its vessels, as they have proven to be of the highest performance and really good value for money, in line with Navantia objectives.

Finally, I would like to thank you and your magazine, Defense Turkey, for the chance to speak on behalf of Navantia.

Defence Turkey: Mr. BLANCO, thank you for sparing time for our readers

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International Anatolian Phoenix 2021

Carried out with the Participation of Qatar - Azerbaijan - Turkish Republic of Northern Cyprus and Turkey

by Cem DOĞUT

International Anatolian Phoenix 2021 Exercise was held during 24 May - 04 June 2021 with the participation of national and foreign elements at the 3rd Main Jet Base Command in Konya. The event was hosted by AKEM (Anatolian Eagle Training Centre Command). Since 2009, the Anatolian Phoenix Military Exercises have been executed at the 3rd Main Jet Base Command in Konya periodically, twice a every year to increase the level of experience required by the current and future's combat zone and to execute the training of the "Personnel Rescue Task Force" elements in the real-like operational environment. One period of the military exercise has been carried out nationally and the other internationally, since 2012.

The exercise aims to test and develop the command control process as part of the Personnel Rescue (PR)

Operation, test the interoperability of the PR Task Force elements (Helicopter, JTAC (Advanced Joint Terminal Attack Controllers), PR and CSAR teams) with the Air Force elements (Fighter jets, Command Control Aircraft and UAV pilots) in the combat zone, develop the "Survival and Escape and Evasion" methods and increase the training level of the pilots and within the scope of Joint and/or Combined Operations plan and execute the tasks such as Personnel Rescue (PR), Close Air Support (CAS), Dynamic Targeting (DT), Time-Sensitive Targeting (TST) by including them in the military exercise scenarios, develop the level of interoperability with other countries and identify areas of cooperation.

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The Convoy Protection, Close Air Support, Casualty Evacuation, Parachute Jump and CSAR tasks are conducted at the Konya Shooting Range as part of the military exercise. The elements participating in this year's exercise are as follows.

- Air Forces Command: Six F-16C/Ds, one E-7T (AWACS) Aircraft, one ANKA-S, one CN-235M-100 and two AS-532AL Search and Rescue Helicopters, three PR (Personnel Rescue) Teams, one JTAC (Advanced Joint Terminal Attack Controllers) Team
- Land Forces Command: One AS-532UL, two T-129B ATAK Helicopters and one PR Team
- Naval Forces Command: One UO (Underwater Offence) Team
- Gendarmerie General Command: One S-70i Helicopter and one PR Team
- General Staff Special Force Command: One S-70A-28 Helicopter and one Special Forces Team
- Turkish Republic of Northern Cyprus: One AS-532UL Helicopter and one PR Team
- Qatar: Two AW139 Helicopter, one C-130J-30 and one C-17 aircraft
- Azerbaijan: Two Mi-17 Helicopter and 3xPR Teams

The Press and Distinguished Observer Day of the military exercise was on 31 May 2021. The activities on the press day started with the transfer to the AKEM Main Briefing Hall and the brief to the press members on the Personnel Rescue, CSAR and Dynamic Targeting scenarios to be conducted at Konya Shooting Range. Later, the air components displayed in the static area were introduced to the participants. Particularly two air vehicles attracted the attention of the press members during this introduction. The first vehicle has been the Special Force Commands' S-70A-28 helicopter equipped with ASELSAN's TCAS (Traffic Collision Avoidance System) for the first time. The other one has been the HÜRKUŞ Air-Ground Integration aircraft (AGIA) with the tail number 17-105 that was manufactured by TUSAŞ. The latter will be soon delivered to 135th Fleet Command. TUSAŞ Product Director Nezaket Güneri ORBAY briefly introduced the HÜRKUŞ and added that they will be delivering training courses on Advanced Air Controller, Advanced Combat Controller and Joint Fire Support Team with the HÜRKUŞ AGIA.

Previously, the F-16C/D and F-4E/2020 aircraft were utilized for such training purposes. HÜRKUŞ AGIA will be eliminating the need for these aircraft. As a result, both training expenses will be severely reduced while the requirement of using fighter jets for training purposes will be terminated. Following the photo-shoot at the static area, the participants watched the air shows of Türk Yıldızları (Turkish Stars) and SoloTürk demonstration teams. The highlight of the air show was the selection of the 132nd Fleet's F-16C Block 30 for the show instead of SoloTürk's specially colored aircraft. The participants arrived at Konya Shooting Range upon the air shows.

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According to the scenario, the Gendarmerie S-70i and Qatar's AW139 helicopter arrived at the zone and started the exercise with the evacuation of the casualties. During the evacuation, HÜRKUŞ AGIA attended the exercise for the first time provided Close Air Support to the helicopters. Later, the elements representing the enemy at the zone were identified by the JTAC team with ASELSAN's SCOUT-II, hand-held integrated electro-optical sensor system and the coordinates of the targets were determined. The identified targets were illuminated with ASELSAN's ENGEREK laser target designator by another JTAC personnel. In this way, the JTAC team directed two F-16Cs on the air towards the targets. The F-16s successfully destroyed all four targets with the 500-pounds' Mk-82 general-purpose bomb.

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Following the destruction of the targets, a Combat Search and Rescue operation was launched to rescue the pilot of the F-16 that crashed due to an engine failure according to the scenario. Support was requested when the ground fire started towards the helicopters arriving at the zone. Two T129B ATAK helicopters reached for help and destroyed the enemy targets with a 20mm M197 cannon. After the security of the zone was maintained, the helicopters landed and PR teams initially ensured the safety of the zone. Then the pilot who has signaled his location with the fog was rescued.

Due to adverse weather conditions, unfortunately, the ANKA-S fires and Parachute jumps in the scenario were cancelled. The military exercise was completed with the salute of the low altitude flight of all air vehicles attending the operation.

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A Brief Overview on Recently Exhibited Platforms During the International ANATOLIAN PHOENIX-2021 Exercise

International ANATOLIAN PHOENIX-2021 Exercise was performed between May 24 and June 4, 2021 at the 3rd Main Jet Base Command / Konya with the participation of military elements of Azerbaijan, Qatar, Turkish Republic of Northern Cyprus (TRNC) and Turkey.

At the Weapons Exhibition held in the static area during the Press and Distinguished Observer's Day of the ANATOLIAN PHOENIX-2021 Exercise (May 31, 2021), HÜRKUŞ Air Ground Integration Aircraft (HYEU) which is to be officially delivered to the 135th Squadron Command within the 3rd Main Jet Base Command and the first S-70A BlackHawk Helicopter of the Special Forces Command equipped with ASELSAN product TCAS (Traffic Collision Avoidance System) also took place.

HÜRKUŞ HYEU Performed its First Demonstration Flight

While the HÜRKUŞ Air Ground Integration Aircraft (HYEU) – the new version of HÜRKUŞ - was exhibited at the static area within the exercise area, it performed a demonstration flight for the first time in such an exercise.

Making a statement during the exercise about the HÜRKUŞ HYEU, President and CEO of TUSAŞ Temel KOTİL said, "HÜRKUŞ HYEU will be used for training purposes, especially by the 135th fleet, during this exercise held with the participation of the commands of various countries. To make it clear, our aim with the HÜRKUŞ HYEU is to train air and ground elements. We want to contribute substantially to our Air Force Command with the HÜRKUŞ HYEU's advanced systems and features."

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HÜRKUŞ Air Ground Integration Aircraft (HYEU), with tail number 17-105, exhibited in the static area and painted with the colors of the 135th MAK and IHK Squadron Command, is actually one of the 15 HÜRKUŞ-B Basic Trainer Aircraft previously produced for Air Force Command but the official acceptance of which yet to be made. Armed and equipped with the Star SAFIRE-380 HLD FLIR payload, the aircraft was classified as HÜRKUŞ-C. According to the information received, the 135th Squadron Command, which is still performing Combat Search and Rescue (CSAR) and Attack Air Control (JTAC) duties, will receive 2 HÜRKUŞ HYEUs in the first stage, and while the concept is identified in the light of the experiences to be gained in the flights to be conducted, a series of modifications can be made on the other 4 HÜRKUŞ HYEUs as per the feedbacks to be received. We do not have any confirmed information regarding whether the Star SAFIRE-380 HLD (with laser targeting device on it) FLIR payload on the first aircraft will be used in the other 5 aircraft (the US Government has previously restricted its export for A-UAVs) or whether it will be replaced with a domestic product FLIR payload. The 135th Squadron Command will use the HÜRKUŞ HYEU to be delivered for JTAC trainings, thus eliminating the need to allocate F-16 and F-4E aircraft for these trainings as before. In order to perform effective JTAC duty, I consider that the image transmission capability has been added to the aircraft (for instant sharing of both the FLIR image and the coordinate information of the marked target with other friendly elements). In this context, I consider that the aircraft has Air Defense Radio Network (HSTA) System established by ONUR ENGINEERING for the Air Forces Command, ASELSAN product software-based 9681 V/UHF Air Radios that enable voice and data communication, and digital IDM-501 Data Modem that enables the transmission of the acquired image data over software-based radio. Air Forces Command currently has the capability of transmitting data over the radio; both ANKA-S A-UAV and Manned ISR aircraft (GÖREN ISR/IKU is able to transmit data/images to F-16s and F-4Es) can transmit the image to very long distances over the radio, and the 1F-6s with Sniper Targeting Pod through the data link device and relay on the pod (GÖREN ISR/IKU)


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KILAVUZ Radio Frequency Signal Analysis System

The International ANATOLIAN PHOENIX-2021 Exercise was held at the 3rd Main Jet Base in Konya between May 24 and June 04, 2021, with the participation of Azerbaijan, Qatar, TRNC, and Turkish Air Force elements. During the exercise, one of the domestic design products that was caught in the lense of our writer Cem DOĞUT was the KILAVUZ Radio Frequency Signal Analysis System (RF SAS), which entered service in 2014.

In line with the needs of the Air Force Command (TurAF), the Radio Frequency Signal Analysis System (RF SAS) Development Project called 'KILAVUZ' was initiated by the Presidency of Defense Industries R&D and Technology Management Department to develop a national system that will compare the radar and jamming signals emitted from hostile Electronic Warfare (EW) platforms, reveal the parameters of the jamming technique, and provide detailed information for analysis.

The project, signed on February 10, 2010, was carried out by a partnership between Havelsan, Havelsan-EHSIM, and SDT. Developed and produced with national capabilities, the KILAVUZ System successfully completed Field Acceptance Tests between 03-07 February 2021, and after successfully passing all tests in March 2014, the system entered the inventory of the TurAF.

In order to bring additional capabilities to the system, the 'KILAVUZ Project Additional Capabilities Acquisition Protocol' was signed, and the upgraded system was accepted in the second half of 2015.

KILAVUZ RF SAS System:

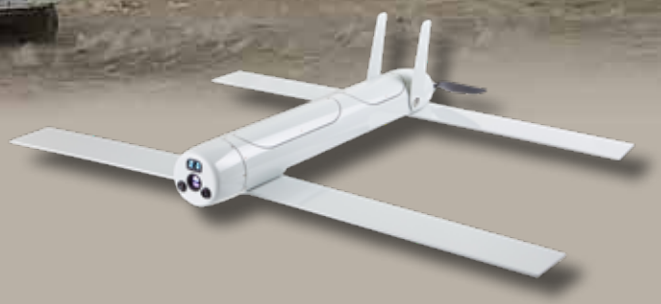
- Detects the signals emitted from target radars and Electronic Warfare (EW) jamming platforms in the test and evaluation environment,
- Measures the broadcast parameters of the target radars and reveals the jamming technique,
- Provides analysis of the interaction of jamming techniques with target radar signals.

The system has a mobile design and consists of,

- Shelter,
- Mast, power, and air conditioning systems,
- Transport truck/trailer,
- Antenna and receivers,
- Central control unit,
- Detection and analysis software,
- Recording system,
- Target tracking systems (Electro-optics, Radar direction finder, etc.) and
- External/internal communication systems.

According to the information we received, the KILAVUZ RF SAS System detects the radar signals of the Russian and Western origin real air defense systems (such as SA-6 Gainful/Straight Flush Radar, SA-8 Gecko, SA-10B Grumble, SA-11A/B Gadfly, SA-15 Gaunlet/TOR, SA-19 Tunguska, D7 Super Fledermaus Radar, ZSU-23/4 Gundish, Skyguard/Sparrow, Rapier Mk2B, and I-HAWK) used in the Electronic Warfare Testing and Training Range (EWTTR/EHTES) during the engagement phase. After analyzing their broadcast parameters, KILAVUZ later monitors the signals emitted by the self-protection (EW) systems of the TurAF aircraft used against these threats and the tactics applied. Therefore, the system contributes to creating a national RF database/library against foreign air defense systems. In short, thanks to the KILAVUZ System, necessary data can be obtained for the development of indigenous EW solutions against threat radars.

ALPAGU Hits Target with Pinpoint Accuracy!



The Fixed Wing Smart Striker Drone System ALPAGU, developed by STM with national engineering capabilities, successfully carried out test firing with ammunition. ALPAGU is capable of effective day and night operation by a single officer and recently demonstrated its ability to hit the target with pinpoint accuracy in the test firing carried out at the Aksaray Shooting Range. In the footage shared the ALPAGU is seen self-destructing through the smart plug on it at 1-2 meters above the target.

After the launch, the loitering munition ALPAGU, which made its flight for about 10 minutes, successfully destroyed its target through image tracking software.

In conventional warfare environments ALPAGU is able to create pinpoint damage to high-value or important targets with its light weight, diving speed and low radar cross-section. ALPAGU will also play a critical role in conducting surprise attacks against enemy elements in the operational field, thanks to its artificial intelligence and image processing algorithms, silent structure, capability of delivering explosives to the target and its loitering munition capabilities.

Launched by pressure from the launch tube, ALPAGU can operate at an altitude of 400 meters, at a maximum range of 10 kilometers, with 10 minutes of endurance and loitering capability. It can dive into enemy targets at 140 km at the right moment and destroy the enemy element at a certain distance above the target as it self-destructs. Its ammunition capacity has been preserved even as its weight was successfully reduced from 3.9 kg to 1.9 kg since its first introduction. Despite its small size and light weight, ALPAGU is able to carry enough explosives to neutralize its target. Currently, only two similar platforms with similar quality under two kilograms are available in the world. Considering that the "Hero-20", the smallest member of the Hero family developed by the American company UVision for anti-personnel missions, weighs 1.8 kilograms and has a 0.2 kg warhead, we can say that ALPAGU has a warhead of similar weight.

ALPAGU kamikaze drone systems are planned to be utilized in blocks (Block-I-II-III-IV) in due course. The ALPAGU also has larger versions with longer ranges and higher speeds, capable of engaging greater targets over 10 kg and carrying more explosives as well. With the capability to develop small sized platforms weighing less than 2 kg, activities are being conducted that will soon render these drones into larger platforms. In addition to the version that could be launched through a launch tube by single personnel, various configurations are being developed that could be launched from armored vehicles or ship-based multiple launchers and that are planned to be integrated to unmanned air platforms such as AKINCI & ANKA.

Capabilities

- Effective Day & Night operation
- Autonomous precision hit with minimum collateral damage
- Detection & tracking of mobile targets
- High performance navigation, control and guidance algorithms
- Can be used by a single officer
- Flight termination and self-destruction modes
- Indigenously developed, advanced electronic ammunition safety, setup and trigger systems
- Indigenous national embedded hardware and software
- High angle lateral viewpoint
- Image processing-based control applications
- Embedded and real-time detection, tracking and classification

Technical Features

- Range : < 10 km
- Mission Endurance : 10 minutes
- Mission Altitude : 400 ft
- Cruise Speed : 50 knots
- Maximum Speed : 65 knots
- Weight : 1.9 kg
- Operating Temperature : -20 / + 50 °C
- Power : LiPo Battery
- Deployment Time : Max 1 minute

July 1st Maritime and Cabotage Day

by N. İsmet HERGÜNŞEN- Retired Naval Staff Colonel

Veteran Mustafa Kemal Atatürk was aware that the Ottoman Empire's naval forces were becoming outdated in various areas towards the end of the empire's reign and strived to ensure the prominence of the Turks with the fortitude of the seas both through his statements and actions during the Republic Period in order to avoid the mistakes made by the Empire.

In the first years of the Republic's foundation, despite the internal and external problems faced, the Turkish Nation realized that the gateway to achieving the level of modern civilizations was through the accomplishment of political, social and economic structural reforms.

The first step towards economic independence had been taken in the seas upon the decisions adopted at the İzmir Economic Congress where the issues related to the development of the nation, that recently survived the war, had been discussed.

The "Cabotage Law" entered into effect by the young Republic on July 1st, 1926. This legislation was one of the fundamental elements of the "Montreux Convention" signed in 1936 and it is also the inspiration of today's "Blue Homeland" doctrine.

Thanks to this law, execution of the transportation of passengers and goods between ports, port management and towage services, was assumed by the Turkish flagged vessels and Turkish citizens.

Though it may be regarded as the declaration of a basic law from today's perspective, when considering the circumstances that prevailed during those times, the hardship experienced in acquiring cabotage rights can be clearly understood.

This right should not only be seen as a right to operate vessels in our country. It should be regarded as the integration of the network of maritime-related economic affairs with the modern world and the development of numerous sectoral areas ranging from training seamen to the ship building sector.

In this way, Turkish maritime with a tradition surviving for centuries and its historical past once again embraced its existence in the seas which had been handed over to foreigners through capitulations.

The incentives provided in recent years resulted in the increase of Turkish Maritime Power in both quantity and quality.

Situational awareness was achieved in our seas that became more meaningful with the "Blue Homeland" concept, which refers to the homeland covering the maritime interests and jurisdiction areas in the Black Sea, Mediterranean and Aegean Sea and the public's positive perception of our Maritime Power was maintained.

Despite all the issues, the level achieved by our maritime is "OK... but is it sufficient?"

Of course, not...

The to-do-list for accomplishing the "A Maritime Nation and a Maritime Country" target:

- A Blue Homeland Political Document should be prepared to achieve a common voice in line with the government's maritime mission and vision.
- Maritime and Turkish Maritime lectures should be included in the curriculum of the 12-year Compulsory Education System in every four-year period and the young population, particularly the ones residing in coastal towns should be motivated towards maritime activities.
- Our working age population should be encouraged to be involved in the maritime profession and the shipping of exports that result in high foreign currency inflow should be adopted as a country policy.
- A social security law in line with the current legislation should be put into effect for the shipman working on the foreign flag vessels or for foreign companies.
- A determined and resilient stance should be displayed against impositions and threats that ignore Turkey's sovereign rights in the seas.
- The seismic research and the activities of drill ships should be conducted in a stable and determined manner in all three seas.
- Actions and discourses that may harm the spirit of the Montreux Convention should be avoided.
- The Black Sea Naval Cooperation Task Group (Blackseafor) built for the maintenance of peace and stability in the Black Sea should be reactivated.
- Turkish type new vessel and yacht building projects should be encouraged to control Maritime Trade and Tourism in our surrounding seas.
- Considering the fact that 75% of our trade, which is valued at US$ 400 billion, is realized through the sea the execution of shipping activities by Turkish flag ships rather than those with the flag of convenience should be encouraged.
- Accommodation-Based
- tourism should include yacht tourism.
- The fishery sector should be directed to the open seas.
- Fishing should be prohibited for the next 2-3 years to avoid the negative effects of the mucilage in the Sea of Marmara and Turkish Straits and penal sanctions should be increased to prevent pollution caused by passages.
- As part of the "September 21st World Cleanup Day", the underwater cleaning of the coastline and the 6 nautical miles of territorial waters should be carried out with the broad participation of the citizens to create an awareness of clean seas.
- To boost the domestic tourism and increase the number of foreign tourists, a Maritime Festival should be organized in the years ending with 0 and 5, in a way to include the July 1st, particularly in the cities of İstanbul, İzmir, Mersin and Samsun.
- To enable the exclusive execution of all maritime activities, a Maritime Ministry should be established and a Maritime Policies Council should take place in the new governmental system.

The only path towards increasing Turkey's welfare and paving the way to success in line with the importance of the seas and maritime activities is through the idea that states the "Blue Homeland requires action rather than a mere discourse."

Happy **"Maritime and Cabotage Day"** to the Turkish Nation!

Following his education in Kabataş High School, Hergünşen graduated from the Naval Military College and joined the Navy. After his assignments on Warships, Torpedo Boats and Frigate Class Vessels, Hergünşen acted as a commander on the TCG Fatih Frigate and as a commodore on Torpedo Boats. He retired voluntarily during his post as a Commander on the Coast Guard Marmara and Turkish Straits Regional Command. He worked as an academician at Bahçeşehir University, Bildeniz and the Maritime Trade Institute

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Feneryolu/Kadıköy-İSTANBUL

DENİZKURDU-2021
Exercise Conducted with the Participation of Over 25,000 Personnel

by İbrahim SÜNNETÇİ

The SEA WOLF (DENİZKURDU) 2021 Exercise, which takes place every two years, was held in the Aegean Sea and the Eastern Mediterranean between May 25 and June 06, 2021. A total of 25,500 personnel took part in the Exercise, which was conducted in 3 phases under the management and administration of the Turkish Naval Forces Commander Admiral Adnan ÖZBAL and the Naval Warfare Center Command (located at Gölcük Naval Base and hosts a state-of-the art Exercise Control Center) with 132 Ships, 10 Submarines, 43 Aircraft, 28 Helicopters, and 14 Unmanned Aerial Vehicles from 10 Public Institutions. Rear Admiral (LH) Yalcın PAYAL, Commander of the TNF Naval Training & Education Command and served as Sea Wolf 2021 Director, also took part in the management and administration of the exercise. DENİZKURDU-2021 was the largest naval exercise ever organized by the Turkish Naval Forces (TNF) in terms of both the number of participating personnel and the number of platforms participating.

A press conference was held for the DENİZKURDU-2021 Exercise on May 24, at the Preveze Hall of the Naval Warfare Center Command at Gölcük Naval Base with the participation of DENİZKURDU-2021 Exercise Director and Commander of the TNF Naval Training & Education Command Rear Admiral (LH) Yalçın PAYAL, Mine Warfare Group Commander Rear Admiral (UH) Ayhan GEDİK, Naval Forces Command Chief of Naval Operations Rear Admiral (LH) Hasan ÖZYURT, and Naval Warfare Center Commander Captain Timur YILMAZ.

Providing information about the course, execution, and purpose of the exercise, DENİZKURDU-2021 Exercise Director Rear Admiral Yalçın PAYAL said, "Exercise DENİZKURDU-2021 aims to test the organizational effectiveness of the headquarters and operation centers of the Naval Forces Command and its affiliated commands, evaluate the judgment, foresight, and decision-making capabilities of Headquarters personnel

Rear Admiran Yalçın PAYAL-DENİZKURDU 2021 Exercise Director


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and the elements participating in the exercise in a high threat environment, and increase the training levels of the Navy elements by testing the cooperation and support procedures with other Force Commands and Public Institutions. Having completed its operational level preparation training with the BLUE HOMELAND (MAVİ VATAN, conducted during February 25th - March 7th) 2021 Exercise within the framework of its annual exercise program, the Turkish Naval Forces (TNF) will carry out its strategic level training based on a generic scenario with the DENİZKURDU-2021 Exercise with much broader participation. Our Naval Forces, which continue their activities with a high operational tempo in all surrounding seas, will have the opportunity to test their abilities with this Exercise." Stating that 12 Frigates, 9 Corvettes, 18 Fast Attack Craft, 10 Submarines, 11 Mine Hunters, 16 Patrol Ships, 33 Auxiliary Ships, 24 Landing Ships, 11 Fixed-wing Aircraft, 16 Helicopters, 14 Unmanned Aerial Vehicles, Naval Special Operations Forces (SAT & SAS), and Amphibious Naval Infantry and Amphibious Assault Teams from the Naval Forces Command will participate in the Exercise, Rear Admiral PAYAL added that a total of 132 Surface Ships, 10 Submarines, 43 Aircraft and 28 Helicopters, and 14 Unmanned Aerial Vehicles from the Turkish Armed Forces (TAF) will take part in the Exercise, including Attack and Utility Helicopters from the Land Forces Command; Fighter Aircraft, Airborne Early Warning & Control (AEW&C) and Transport Aircraft from the Air Force Command; Search and Rescue (SAR) Team and Search and Rescue Helicopter from the Gendarmerie General Command; Special Forces Teams and helicopters from the Special Forces Command; and lastly Search and Rescue Corvette, Coast Guard Boats and Coast Guard Helicopters from the Coast Guard Command.

Responding to our magazine's questions during the Q&A session of the press conference, regarding the new munitions and weapon systems (referring the ULAQ Armed Unmanned Surface Vehicle [AUSV]'s firing tests carried out off the cost of Antalya) during the Exercise, Rear Admiral PAYAL said: "The DENİZKURDU Exercises are generally executed at the strategic level, and trying newly procured munitions, or weapon systems is not part of their primary purpose. Therefore, we test our new weapon systems in the other activities that are planned independently from these exercises. This exercise is carried out to test all capabilities, personnel, materials, equipment, doctrine, and procedures at the strategic level. No specific weapon system was planned to be tested."

After the Q&A session we visited the state-of-the art Exercise Control Center established at Naval Warfare Center Command. The exercise was carried out based on a generic scenario that was designed within the framework of the training objectives determined with the joint participation of all TNF headquarters, and this scenario was controlled and managed from the Exercise


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Control Center. Thanks to its technological infrastructure and communication equipment, the Exercise Control Center, where some 150 personnel were employed, was able to communicate with all of the participating units in the DENİZKURDU-2021 Exercise in real time and near-real time speeds.

The DENİZKURDU-2021 Exercise was conducted in 3 phases; Operational Readiness (on May 25-27), Free Play (held between May 28 - June 02) and Distinguished/ VIP Observer Day & Harbour Visits held between June 02-05). In the Operational Readiness Phase, participating units conducted operational readiness drills including Anti-Surface Unit Warfare (ASUW), Anti-Submarine Warfare (ASW), Air Warfare/Air Defense (AW/AD), Amphibious Warfare, Mine Warfare, Electronic Warfare (EW), Live Firing, Joint Training, Coastal Troops Training, Submarine Personnel Rescue Training, Maritime Control Operation, and Asymmetric Threat Training. During this Phase, Basic Naval Warfare and live firing training took place. In the Free Play (Force-on-Force Freestyle Training) Phase, crisis management training based on a four-day crisis scenario was prepared with the participation of all Forces and was carried out under the command of the Exercise Control Center of the Naval Warfare Center Command. In the last phase of the Exercise, 83 ships conducted 22 port visits in the Aegean Sea and the Eastern Mediterranean and within the framework of COVID-19 measures this year, the ships will not be opened for public visits.

Following the completion of the port visits, on June 5, 2021 the fleet hosted a Distinguished/VIP Observer Day in the Eastern Mediterranean that saw a gathering of officials from the Turkish MoND and the military command echelon as well as military attachées from 25 countries. Distinguished/VIP Observer Day witnessed the first ever live firing of MAM-L smart munition from a BAYRAKTAR TB2 UCAV against a live surface target (decommissioned auxiliary ship Pınar-6 [Y-116]).

Ibrahim SUNNETCI is seen here at the Poyraz Pier in Gölcük Naval Base

Within the scope of the Sea Wolf 2021 Exercise on May 26 (with telemetry head) and May 27 (salvo firing with live warhead) the ULAQ Armed Unmanned Surface Vehicle (AUSV), developed by Turkish companies Meteksan Defence and ARES Shipyard, successfully performed CIRIT Semi Active Laser Guided Missile firing tests towards a fixed target on the Devecitası Island off the cost of Antalya and all of them successfully hit the target. On May 27, 2021, directed from the Mobile Coastal Control Station (MCCS) and transferred to the firing area, the ULAQ AUSV engaged the target via on-board sensors and achieved a direct hit with two CIRIT Laser Guided Missiles while navigating at high speed. The Turkish Naval Forces Command and Coast Guard Command platforms also accompanied the firing test ■

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The World's First Laser Guided Missile System Integrated AUSV "ULAQ" Successfully Hits Target

The ULAQ Armed Unmanned Surface Vehicle (AUSV), developed by Turkish companies Meteksan Defence and ARES Shipyard, successfully completed missile firing tests during the Turkish Navy's Sea Wolf 2021 Naval Exercise. According to the video footage, two CIRIT Laser Guided Missiles were fired from ULAQ AUSV in series and the target was successfully hit by the ULAQ with a salvo of shots fired on May 27th.

Within the scope of the scheduled firing test of the naval exercise, ULAQ launched the Roketsan-made CIRIT missile with telemetry on May 26th and following the first successful launch test, the CIRIT Missile that was fitted with a warhead was successfully launched and hit the target by the ULAQ AUSV on May 27th.

The ULAQ AUSV firing ceremony was attended by senior officials from Turkey's Presidency of Defense Industries (SSB), Ministry of Defense, Turkish Naval Forces Command and Coast Guard Command, and started with speeches from ARES Shipyard CEO Utku ALANÇ and Meteksan Defence President Selçuk ALPARSLAN.

ARES Shipyard's CEO Utku ALANÇ expressed that with the completion of the firing tests, they are aiming to develop the World's Best Unmanned Surface Vehicles and become pioneers in the world as Turkish Engineers in this field. He also underlined that they have targeted bringing Turkey into a leading position in the world, creating trends in the field of USVs, just like the indigenous UAVs.

Meteksan Defence President Selçuk ALPARSLAN stated that as Turkey, while pioneering the doctrines rewritten in the world military conjuncture, they were immensely proud of the firing tests of the ULAQ AUSV, which were carried out within Sea Wolf 2021, the most comprehensive naval exercise in the history of the Turkish Republic.

After the opening speeches, the ULAQ AUSV, which was positioned in the south of Antalya Bay with the Turkish Navy's other combatant manned platforms, was activated and was directed from the Mobile Coastal Control Station (MCCS) and transferred to the firing area. The Naval Forces

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Command and Coast Guard Command platforms also accompanied the firing test. After the target was detected by sensors on the ULAQ, CIRIT Laser Guided Missiles were fired and resulted with a direct hit on the target.

President of Defense Industries (SSB) Prof. Dr. İsmail DEMIR made a speech to express his feelings after the successful firing, which was eagerly awaited by all the spectators. Prof. Dr. Demir used the following words in his statements: “Today, it is obvious that we must have a naval force for the protection of the Blue Homeland and the protection of our rights in the Aegean and Eastern Mediterranean. In order to provide the platforms needed by our Naval Forces as the indomitable guardians of the Blue Homeland, equipped with the latest technologies, we will continue to work as the Presidency of Defense Industries in close cooperation with our Ministry of Defense, General Staff, Naval Forces Command, our industry and other relevant institutions. We have reached an indigenousness rate of up to 70 percent in our projects, and we will increase this even more.

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The days have come where we began to see similar products to the game changer UAVs, now in land vehicles, surface vessels and submarine forms. We are aware that combat environments with integrated unmanned systems await us and therefore we continue our work accordingly. We are supporting the endeavors to be put forward in this regard and we will continue to support them".

The ULAQ AUSV is Turkey's first armed unmanned surface vehicle and can be operated via mobile vehicles on land and from a headquarters command center or from floating platforms such as aircraft carriers and frigates in the execution of missions such as Reconnaissance, Surveillance and Intelligence, Surface Warfare, Asymmetric Warfare, Armed Escort and Force Protection, and Critical Facility Security.

The ULAQ AUSV is equipped with four CIRIT and two L-UMTAS Missile Systems provided by Turkey’s missile systems manufacturer ROKETSAN. The ULAQ AUSV can also be configured with different types of payloads such as extended range surface-to-surface, surface-to-ground, surface-to-air missiles, electronic warfare, jamming, and different communication and intelligence systems as well as missile systems to meet different operational requirements.

Moreover the ULAQ AUSV is not only a remotely controlled unmanned vehicle, but a state-of-the-art autonomous vessel with superior capabilities thanks to its artificial intelligence features. It has the capability to operate with other AUSVs with equal or different structure, and conduct joint operations with UAVs, AUAVs, TUAVs and manned aircraft.

Following the AUSV version, which is the first phase of the project initiated by ARES Shipyard and Meteksan Defence, production will also begin on unmanned surface vehicles for intelligence and electronic warfare, mine hunting, anti-submarine warfare, firefighting and humanitarian aid/evacuation.


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Turkish Defense Industry Demonstrated Capabilities at the 3rd Efficiency and Technology Fair

Organized by Türkiye Verimlilik Vakfı (Turkey Efficiency Foundation) with the theme of "Advanced Technologies" the 3rd Efficiency & Technology Fair was held at the ATO Congresium this year on June 9-12. The objective of the fair was to showcase technological products and studies that contribute to the improvement of efficiency in our country and the world, while raising awareness about efficiency. High tech products were exhibited at the fair which was attended by prominent Turkish and global enterprises active particularly in the defense industry and education, energy, agriculture, communication, transportation.

Vice President Fuat OKTAY, Minister of Industry and Technology Mustafa VARANK, Minister of National Defense Hulusi AKAR, President of Defense Industries Prof. İsmail DEMİR, and many government officials attended the 3-day fair that hosted a considerable number of industry executives. Defense Industry products from companies such as Aselsan, Roketsan, Haveslan, TÜBİTAK Sage, TUSAŞ, MKEK, Sarsılmaz, and SDT were exhibited during the fair.

Taking the floor after Ankara Science University's President Prof. Yavuz DEMİR, Minister of Industry and Technology Mustafa VARANK stated that the increase in global trade allowed for the effective utilization of international economic competition, resources, workforce and added, "In addition to a strong impact on the competitive power of countries and companies, efficiency is indispensable for sustainable growth. Considering the rapid digitalization in our world following the novel type Coronavirus (Covid-19) pandemic, the way to maximize efficiency is through Advanced Technologies, which is also our fair's theme. Such transformation in progress with the launch of programmable machines continues to stand out with the 4th Industrial Revolution presently led by modern automation systems. From past to present, we have been observing a single common aim in the outcomes witnessed upon the Industrial Revolutions. And this is a remarkable increase in efficiency."

by Saffet UYANIK

Underlining that the Industry and Technology Strategy for 2023 was designed in line with the National Technology Move, VARANK stressed that they prioritized the acceleration of the industry's technological transformation, becoming the manufacturer of critical technologies and increasing R&D's share in the national income. VARANK mentioned that they aimed to invest in a qualified labor force and launch

"TURCORN" which develop products and services that are used worldwide and continued, "We are willing to become a trendsetter country in technologies such as digitalization, space, artificial intelligence, and autonomous systems, instead of a country that follows the world. We designed our National Space Program based on such a vision. We are about to complete our road maps under the titles of mobility tools, smart life and health, digital transformation, artificial intelligence, and 5G. We designed the National Artificial Intelligence Strategy covering the 2021-2025 period with the Presidency's Digital Transformation Office, and we will soon share the details of this strategy with the public."

VARANK pointed out that they redesigned the Ministry's support and incentive mechanisms according to the aforementioned titles and he noted that they are encouraging SMEs to manufacture technology and are supporting the increase of SMEs utilizing these technologies. "Only in 2020 alone, we contributed to 396 projects, amounting to TRY 158 million, that focused on digital transformation. We have been carrying out R&D, Product Development, and Innovation Support Programs to enhance the production capacity of businesses and to render them more efficient and competitive. With the help of KOSGEB (Small and Medium Enterprises Development Organization), we raised a fund of TRY 889 million just in two years for nearly 10 thousand SMEs regarding support programs prioritizing technology levels and indigenous production. Also, as part of the Technology-Based Industry Program, which we started to implement in this period, we included the 'Mobility' sector in 2021 for the indigenous production of advanced technologies and products in which we face a current deficit. Moreover, we will be working on 'Structural Transformation in Production,' 'Health and Chemical Products,' and 'Digital Transformation.' We will continue to provide support to increase efficiency in all areas and enhance the production of advanced technologies," said VARANK.

Minister VARANK underlined that they stepped up gears in all areas to become a leading country in advanced technologies while encouraging the industry and technology ecosystems throughout this transformation.

Mustafa VARANK- Minister of Industry and Technology

VARANK emphasized the importance of investing in the right technology at the right time and added, "Ten years ago, we strived to import UAVs and had to wait for their repair and maintenance in the aftermath. Thank God, now Turkish A-UAVs developed by Turkish engineers are looking forward to flying over the European skies. Presently, the entire world is speaking about the unmanned air vehicles that Turkey has developed. I am constantly being asked to comment on the F-35 Program. The F-35 is indeed a successful aircraft, but we have been developing its equivalent as part of the National Combat Aircraft project with TUSAŞ. Above all, Turkey is currently amongst the few countries to invest in combat UAV technology. Hopefully, when we launch our combat UAVs to the market, the whole world will be talking about the UAVs developed by Turkey, leaving the F-35s aside."

Vice President Fuat OKTAY delivered a speech after the Minister of Industry and Technology Mustafa VARANK and underlined that they accomplished Turkey's 'structural transformation with high added value' and 'sustainable economic growth' targets as part of the 'Indigenous Technology, Powerful Industry' vision and added, "The secondary axis of our vision of industry is an increase in efficiency, digital transformation, and regional development. As soon as we entered this fair venue, we had the opportunity to once more witness together the concrete results of the level our country has reached in these three axes. Our indigenous and national defense industry projects

Vice President Fuat OKTAY and TUSAŞ CEO Temel KOTİL

are displayed here, and our prominent universities that are pioneers in R&D are present here with their products. Advanced technology is not far away from us. Without a doubt, we have a long way ahead and many challenges. So far, we have established 1,239 R&D centers and 79 Technoparks, and we continue to work more to achieve more."

Vice President OKTAY noted that they have been executing 750 Defense Industry projects valued at over US$ 60 billion and underlined that they would be raising this project volume to higher levels. Stating that areas such as artificial intelligence, the internet of things, augmented reality, big data, robotics, cybersecurity, and sensor technologies have been identified as the primary critical technology areas for development, OKTAY continued, "Providing support to the initiatives and discoveries in these areas is our priority. We will become a much stronger Turkey in the years 2053 and 2071 with an economic model reinforced with high technology and increased efficiency."

OKTAY mentioned that quantum technologies, interplanetary internet, automation, advanced nanotechnology, picotechnology, and wearable indigenous and national technologies could be on display in fairs to come and continued: "We cannot waste any of our country's resources, particularly energy, raw material, and capital. We cannot waste our time, either. I believe the indigenous technology projects, of which we are presently building the infrastructure for, will be our most precious inheritance to pass on to future generations. Encouraging the projects that would increase efficiency and the Turkey Efficiency Foundation's activities for developing the efficiency culture in society are essential. The activities geared towards improving efficiency will be extended to the masses through this fair, just like the past two events. In this way, society's awareness in efficiency will increase, as will the strength of coordination between the sectors."

Attending the 3rd Efficiency & Technology Fair in the afternoon, Minister of National Defense Hulusi AKAR stated in his remarks that the rapid development of technology was clearly felt in all aspects of life. Minister AKAR noted that countries that own and effectively utilize technology gain an advantage in the international arena and underlined that the countries that lack in technology or fail to adapt to the developments remained as markets and were subject to all types of threats and danger. Stressing that remarkable progress was achieved in almost all areas, in defense technologies, in particular, Minister AKAR added, "We managed to increase domestic participation and the indigenousness rate in our high-tech defense industry to over 70%. We aim to carry this rate to the level of 75-80% in 2023." Stating that local defense industry companies reached a level to be able to compete with major global companies and that 7 local companies were now listed among the world's top 100 leading defense industry companies, Minister AKAR continued, "In the past, we even imported our infantry rifles, however, presently we achieved the competency to design, manufacture and export our indigenous infantry rifles, our warships, frigates, UAVs/A-UAVs, Fırtına howitzers, multiple rocket launchers, ATAK helicopters, smart precision-guided munitions. Moreover, our radar and electronic warfare systems, missiles, and munitions have strengthened our army further in domestic and cross-border operations. Besides, our activities regarding the National Combat Aircraft, the Siper Air Defense System, and the Anadolu Amphibious Assault Ship are being carried out intensely and successfully."

Minister AKAR stated that in addition to covering Turkish Armed Forces' needs, they are presently able to cover the defense-related requirements of friendly and allied nations

Hulusi Akar- Minister of National Defense

and added, "The Turkish Armed Forces has now reached the advantages and operational superiority availed by high-technology that can be achieved by only a few armies in the world. Indeed, the Turkish Armed Forces (TAF) has been intensely, effectively, and selflessly fighting valiantly to protect our country and our friends' and brothers' rights and to contribute to regional and global peace and stability in our country and in Syria and in the northern part of Iraq, in Cyprus, Azerbaijan, Libya, East Mediterranean, in the Aegean region and in many other locations."

Minister AKAR expressed that they have been endeavoring to develop their technology to meet the TAF's needs and to render it more effective and continued: "The shape that the operational environment will be taking in the future is getting far too complicated to be tackled with classical approaches and traditional thinking methods. Considering the operation's form and execution in the future, our defense industry's path should be identified by new military requirements. We intend to avoid being late in including robotic and autonomous systems equipped with artificial intelligence, that are regarded as technologies of the future. We wish to prepare our army in advance for the capability to fight with the speed of a machine. Because the powerful armies of the future, those that will achieve major accomplishments will be the ones at peace with science and technology, furthermore the ones leading in technological developments. To that end, we are closely following developments regarding artificial intelligence, the internet of things, big data, cyber-physical and robotic systems, and autonomous systems. There are many products and technologies that are currently being used, ranging from swarm drones to quantum radars, from midget submarines to laser guns, from directed-energy weapons to micro-satellites, and all these products and technologies are also being improved. Such products started to take part in the operational area, and their utilization will continue to increase."

Prof. İsmail DEMİR- President of Defense Industries

Minister AKAR pointed out that along with land, air and sea, space and cyberspace became critical operational fields in defense technologies of the future and concluded his speech: "Having an upper hand, especially in the cyber systems area, has become a prerequisite for becoming successful in other operational areas. Collaboration of academicians, industrialists, and the Turkish Armed Forces in a coordinated manner in the development of such technologies required or to be required for warfare will hugely benefit the rapid progress of systems. We will carry out our activities without slowing down, mobilize all our facilities, and work without giving up. We will not lag-behind any country. We have confidence in our human resources, our potential, and our defense industry that shall transform this potential to power to achieve our targets. Good things happen when one believes in them, better things happen when one is patient, and the best things happen when one never gives up. There is no doubt we will embrace greater achievements with our belief, patience, will, and decisiveness."

President of Defense Industries Prof. İsmail DEMİR attended the seminar titled "Defense and Space Technologies After 2023," held on the second day of the event as part of the 3rd Efficiency & Technology Fair. In his speech, DEMİR underlined the importance of a technology-based defense industry that will guarantee Turkey's security and said, "Competence in the technologies that will maintain our country's and citizens' security is critical. Our country's future and our guarantee of independence lie within the saying 'If you want peace, prepare for war,' and this can be achieved through an effective indigenous and national defense industry. Surely, the human parameter is crucial in the utilization of technological equipment and products. The weapons may fail to be effective if the citizens lack in courage and ethical values."

DEMİR stressed that they aimed to increase the resources allocated to R&D and technology investments, particularly in recent periods, to enhance technical efficiency and continued, "The products used in the field have been increasing our country's security and the power of the TAF. I would like to underline the necessity of launching implementations in various technology areas as these products play a major role in society's security and peace. Surely, the countries lacking such strengths would fail to survive. However, the ones failing to use such powers well would not survive, either. Nations that do not

have significant national power will have to lag behind in the international competition." DEMİR also added, "When speaking of power, we mentioned technology and workforce. Human resources are the most critical strength of any country. Considering Turkey's most crucial power, the dynamic, young, and highly qualified human resources is the guarantee of our future. We have a young population, and this population must be improved. Its future should be illuminated. To avoid wasting any of its time, its progress should be kept in line with the targets. Effective utilization of human resources is of vital essence. If we fail to achieve this, we will experience a major waste of human resources. Education sits at the top of the main factors regarding achieving well-versed staff. Along with obtaining the know-how, embracing staff with ethical values to use this know-how in a humane manner is critical."

DEMİR also stated that if a country lacked a strong Industrial and Technological infrastructure, then it would not be sound enough to claim a powerful stance in the defense industry and added that a vast Industrial and Technological infrastructure is critical to have a sustainable defense industry and own globally leading technological products, particularly in certain strategic areas.

DEMİR informed participants about Turkey's road map for space and underlined that satellites were the first concept on the agenda regarding this area. Stressing that activities conducted in space would continue to increase, İsmail DEMİR added, "God willing, we will proceed towards a world where we have our indigenous communication and observation satellites in space, where we travel to space with our launching systems and where we have various modules to conduct space travel." President of Defense Industries DEMİR underlined that the communication and observation satellites were built by collaboration with foreign companies. DEMİR added, "Both our communication and observation satellites were manufactured by the cooperation built with international companies. They were launched to space with an ever-increasing rate of domestic participation. Facing ourselves at this point, we need to own launching systems to access space, manufacture our satellites, have products with space history, and mature our space-related technologies. Presently we can claim that we have rockets that are able to reach space. The activities regarding space are usually scientific activities conducted with peaceful and civilian purposes. All these activities contribute to areas such as observation, communication, and other areas and unavoidably to the area of defense. In this respect, Roketsan has reached space with its solid-fuel rocket engines, at an altitude of over 150 kilometers. We can raise this altitude. Now we can send our systems, conduct gradual missile firing, and control direction in space. Surely, these are not sufficient; we need to own all missile engine technologies. We launched space travel with hybrid rockets, with rockets with solid and liquid fuel. Space travel will continue to increase after 2023 as well. We hope we will proceed into a world where we have our indigenous communication and observation satellites, where we can travel to space with our launchers, and where we have various modules to conduct space travel. The capabilities and technologies developed by the defense industry will constitute the main technology areas of this journey."

Haluk GÖRGÜN, Temel KOTİL and Celal Sami TÜFEKÇİ

Following President of Defense Industries İsmail DEMİR's speech, Vice President of Defense Industries and ULAK Communication Chairman of the Board Celal Sami TÜFEKÇİ, Aselsan Chairman and CEO Haluk GÖRGÜN, and TUSAŞ President and CEO Temel KOTİL took the floor during the second session. GÖRGÜN started his remarks by informing participants on the output of Aselsan's yearly activities and noted that Aselsan successfully created remarkable employment opportunities in Turkey. GÖRGÜN stated that they concluded the year by increasing the company's previous turnover of TRY 13 billion to TRY 16 billion and underlined their contribution of over 1,200 employment opportunities. GÖRGÜN also pointed that they

signed international export contracts that amounted to US$ 500 million during the pandemic process.

Relaying information on Aselsan's high-tech defense products, which have been either launched to utilization recently or are under the design stage, GÖRGÜN continued, "We may mention the SİPER Long Range Regional Air and Missile Defense System Project, Top Layer Ballistic Missile Defense System Development Project, National Combat Aircraft Project, National GPS Satellite, Artificial Intelligence Deputy Commander to support the military units in the field, autonomous land, air and naval vehicles operating in swarms, communication equipment over TURKSAT-6A, KARAKULAK High-Frequency Shortcut Rest Systems as examples of our high-tech defense products." Stating that they attended the Fair with 26 sub-contractors, GÖRGÜN also spoke of Aselsan's activities in indigenous products. "In line with our mission of establishment, we have been placing great importance on activities regarding indigenous projects. In the last three years, we have availed over 750 products for nationalization and indigenization applications. We have nationalized over 400 products and achieved over US$ 150 million of contribution to our country's economy. We are aware that we have a long path to cover. We will absolutely achieve better and more

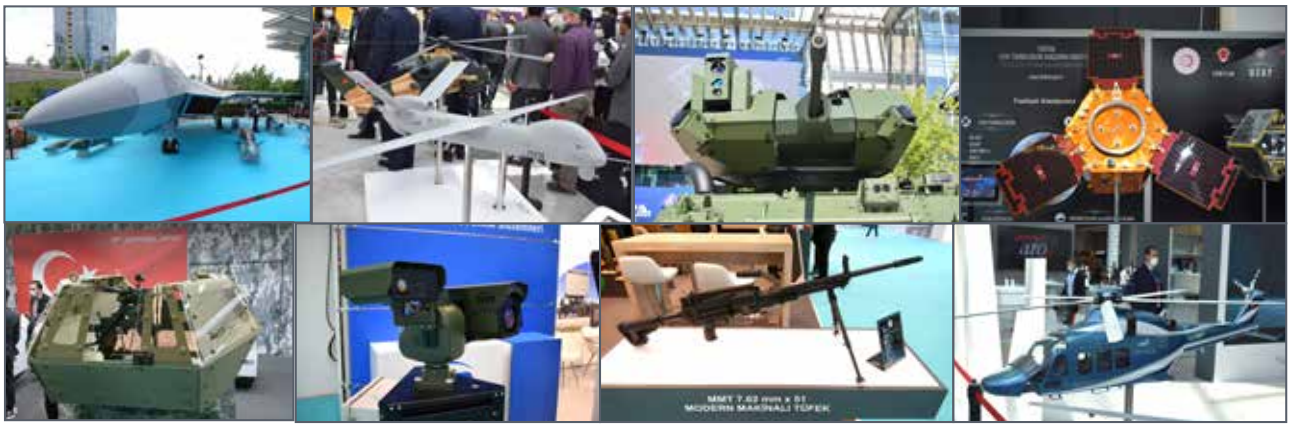
Haluk GÖRGÜN- Aselsan Chairman & CEO

updated products as we proceed and evaluate our accomplishments. We strive to proceed with the help of such experiences. Nationalization and international business development are among the critical notions for our company."

In his speech, TUSAŞ President and CEO Temel KOTİL said, "GÖKBEY conducted its flight smoothly as if it was built by a company in business for 100 years. It is presently being prepared to be delivered to the Gendarmerie General Command. Within this scope, we will be executing three helicopter deliveries within a year. For the time being, GÖKBEY is the world's best helicopter in its category. We are presently a world-ranking company, and we wish to become one of the top five helicopter companies. There are over 4 thousand engineers in our company, and we are heading towards 5 thousand engineers. The number of employers reached 10 thousand by adding 1,500 technicians and 500 experts to our staff. God willing, we will reach a staff size of 20 thousand. On the other hand, our number of engineers is proceeding towards 10 thousand from 4 thousand."

KOTİL mentioned TUSAŞ's other ongoing projects and said, "Our second helicopter is the Heavy Class Attack Helicopter T929. We name it '25' when it is civilian and use '29' for military purposes. T625 (GÖKBEY) is a 6-ton helicopter; T929 weighs 11 tons. It is larger than the model (A129), which we nationalized under an AgustaWestland (Leonardo) license. TUSAŞ presently develops T129, T70, T625, T629 (6 tons, slightly larger than the Atak), T925 large civilian helicopter, and T929 with its resources. No other company has such a high number of projects. There is also the HÜRKUŞ. The indigenous and national training and fighter jet HÜRJET will hopefully be in the skies on March 18, 2023. There is also the MMU project (National Combat Aircraft). Finally, yet importantly, we have the ongoing ANKA and AKSUNGUR projects, we have other UAVs as well, but I will mention them later. HÜRKUŞ has been put into service; HÜRJET will fly in 2023 and will enter service in 2025. The MMU will start flying in 2025 and serve in 2028. As part of the MMU project, we exceeded 1,000 engineers and have been heading towards 3,000."

Delivering the final speech of the session, ULAK Communication Chairman Celal Sami TÜFEKÇİ said, "My definition of the concepts' Indigenous and National' does not imply that a country conducts 100% of stages and components alone. If one owns the technology, manufacturing a product in another location is possible. Indigenous production creates employment, and indigenous technology contributes to the increase in national income. We can increase Turkey's current national income from around US$10 thousand to US$20 thousand in the short run with companies such as ULAK that produce technology with added value. We will soon launch a smart Organized Industrial Site capable of communicating via 5G in the HAB Aerospace Zone by building our lines. Our ecosystem has been expanding in this sense. At the same time, many of our companies will be carrying Turkey a step forward in communication technologies by supporting ULAK. The ecosystem created in this area is quite valuable. Without an ecosystem and without technology-based efforts, one cannot



produce and increase indigenousness. To that end, we built technology-based projects through which we can push the rate of domestic participation to over 80-90% in the defense industry from the current level of 70%."

During the 3rd Efficiency & Technology Fair, Aselsan also held a presentation ceremony about the company's nationalization efforts in the Turkish defense industry. Aselsan carries out nationalization activities to reduce foreign dependency and supply risks in the defense industry. Within the scope of these activities, Aselsan analyzes the products that have difficulties in procurement from abroad and shares its studies with its business partners. Aselsan Chairman and CEO Haluk GÖRGÜN, who took the floor at the ceremony, stated that the Covid-19 outbreak increased the dependency on production and service centers while reshaping global supply chain rules. "The ongoing extraordinary conditions have left our country, which has strong competitive advantages, to face new threats and opportunities. In this transformation process, we see our valuable business partners, who play a decisive role in Turkey's competitiveness in various sectors, especially in the defense industry, as the most important part of our production chain. We continue in our activities by getting stronger with the vision of nationalization that we have created. With this understanding, we added a milestone this year to our organizational transformation process that we started in 2018, bringing our supply chain management to the assistant general manager level. With our new organization, we aim to transform our supply chain management to a sustainable, simple, and agile structure."

Emphasizing that Aselsan places great importance on nationalization efforts within the framework of its founding mission, Haluk GÖRGÜN stated that they established the 'National and Domestic Product Development Committee' three years ago to strengthen the bond between them and their suppliers and to carry out nationalization studies in a more systematic manner. "Within the framework of our founding mission, we want to strengthen the bond between our suppliers and us to increase the effectiveness of nationalization efforts and further reduce foreign dependency. In line with this purpose, we established the 'National and Domestic Product Development Committee' three years ago to carry out our nationalization efforts more systematically. Within this committee, we prepare technical information brochures for the products to be nationalized. To date, we have opened more than 750 products to nationalization applications, and in the last three years, we have nationalized approximately 400 products with your efforts. We have increased our domestic procurement rate above 70%, and we will raise it even higher. We gathered our suppliers under an integrated roof and created the 'Gücümüz Bir' platform. We consider that KOSGEB and our defense industry clusters play a vital role in the nationalization process. Today, we will sign cooperation protocols with KOSGEB, SaSaD, ODTÜ Teknokent, and the OSTİM Defense & Aviation Cluster. I hope that the protocols we will sign with these institutions, which have an important part in Turkey's defense exports with their qualified capabilities, will benefit our country. Another priority is to develop our effective supply chain by continuously finding domestic suppliers. In this direction, we will present their certificates to the newly approved companies today. In addition, we will increase the number of our contracted banks to 13 by adding one more to our cooperation with 12 banks to facilitate financing for our supplier companies."

After the presentations, the Aselsan defense industry clusters and associations cooperation protocols signing ceremony was held with the participation of Aselsan Chairman and CEO Haluk GÖRGÜN, KOSGEB President Hasan Basri KURT, SaSaD Vice Chairman of the Board Uğur COŞKUN, OSTİM Defense & Aviation Cluster (OSSA) Vice Chairman of The Board İbrahim YARSAN and ODTÜ Teknokent Defense Industry Cluster (TSSK) Chairman of the Board Zeynep ÖKTEM

Aselsan's New Electro-Optical Solutions for National UAV Platforms

by Saffet UYANIK

The 3rd Efficiency & Technology Fair was recently held between June 9-12 this year and Aselsan Engineer Cihan PİRİMOĞLU made a presentation titled "Aselsan Electro-Optical Solutions for our National UCAVs", sharing important information about Aselsan's CATS and ASELFLIR-F500C electro-optical (E/O) systems that were developed for fixed and rotary wing platforms, and the ASELFLIR-600 system, which is still in the design process.

The Common Aperture Targeting System (CATS), the first product developed by Aselsan for national UAV/UCAV platforms, takes its name from its system architecture. Developed with Aselsan's own resources, CATS was designed to increase the targeting, reconnaissance & surveillance capabilities of medium altitude unmanned aerial vehicles in all weather conditions, day and night. The Common Aperture of CATS has a Cassegrain structure that is optimized to receive all wavelengths (thermal, daylight, SWIR) with the same optical lens, unlike equivalent systems. In this way, high electro-optical performance is achieved in a small volume with a single optical window for all imaging channels. Additionally, thanks to the Common Aperture, different sensors that do not normally fit inside a certain gimbal volume can be integrated into a single system, unlike Distributed Aperture E/O systems.

CATS has 6-axis image stabilization, including 4-axis mechanical stabilization for the gimbal and 2-axis precise optical stabilization for the mirror mechanism. CATS feature multi-target tracking capability. Aselsan stated that they achieved less than 5 microradians (μrad) sensitivity with UAV/UCAV platforms. CATS is ground stabilized (can lock to a point on the ground), can lock and set orientation to GPS coordinates, or calculate the coordinates of a tracked target. The CATS use system-specific image processing algorithms, many of which are patented. With Visual Object Tracking (VOT), CATS can calculate the position, direction, and speed of the target with high accuracy. It can also mark the target with its Laser Designator and direct laser-guided munitions with high precision.

Following the embargoes on electro-optical systems used in UAV and UCAV systems in 2020, Aselsan made some changes to optimize the CATS system. First, the thermal sensor of the CATS system has been improved so that the range and image quality performance obtained in good weather can also be achieved in adverse weather conditions as well. Aselsan switched to a dual-gain sensor, which can capture a higher level of signals by changing the gain parameters in adverse weather conditions and in cases where the temperature drops in winter. The second change is that certain environmental conditions can reduce the signal detection capacity. This increases the load on the electronic components and, in turn, raises the internal temperature, especially in gimballed E/O systems with limited volume, creating a "noise" that decreases the sensor output. Aselsan managed to reduce the internal temperature to +15°C under certain conditions and solve the noise problem by changing and adjusting the electronic components. The third change is weight optimization for use in UAV/UCAV platforms. Initially, CATS was 62 kilograms, and then its weight was reduced to 56 kilograms after further optimization studies carried out in 2020 and 2021. Aselsan continues its efforts to reduce the weight of CATS from 56 kilograms to 55 kilograms.

Furthermore, Aselsan aims to increase the performance of CATS considerably by changing its algorithms (both daylight and thermal), along with the newly developed electronic equipment. Aselsan has succeeded in seeing the designator laser, which can only be viewed at night in certain conditions,

in both day and night with various filters integrated into CATS (filters all wavelengths except the laser) and verified these improvements in operational environments. Currently, only specific frequencies can be viewed with the low-light camera. However, Aselsan continues its studies to view all PRF (Pulse Repetition Frequency) codes that are necessary to guide all the laser-guided munition types used by fighter jets with UAV/UCAVs. Significant gains have been achieved in laboratory and systemlevel studies" yerine "Aselsan achieved significant results in laboratory and systemlevel studies.

In his presentation, Cihan PİRİMOĞLU emphasized that because of Aselsan's nationalization studies on sensors, which are the most critical components of Electro-Optical systems, and their cooperation with East Asia and Chinese companies following the embargoes, Aselsan accessed High-Definition (HD) detector technology and subsequently started the development of the ASELFLIR-F500C system last year. PİRİMOĞLU said, "As Aselsan, we carry out dozens of different projects from VGA (Video Graphics Array) formats to HD formats with MCT (Mercury Cadmium Telluride) and superlattice technologies in cooled systems and metal and silicon-based packages in uncooled systems. Some of these are Aselsan's own projects, and some are carried out for critical projects such as the Altay MBT,

Turkish Fighter (TF-X), CATS, AF-500C, with the support of the Presidency of Defense Industries (SSB). We continue our efforts to begin the serial production phase of HD detectors very soon. These sensors are highly critical components that can severely hamper both design and production processes in case of embargoes. Right now, we have multiple sensor alternatives for our systems, such as CATS, ASELFLIR-300T, and ASELFLIR-F500C, both from within Aselsan and from the East Asia and Chinese companies."

While some of the uncooled detectors (YAMGÖZ Close Range Surveillance System and ADIS Driver's Vision System) used in the Altay Main Battle Tank (MBT) and the M60TM Fırat Modernization Projects are Aselsan products, some of them are supplied by other sensor companies. Aselsan continues its studies to produce all these detectors. Aselsan also continues its efforts to nationalize the infrared (IR) detectors used in the CATS, ASELFLIR-300T, ASELFLIR-F500C, and the commander's and gunner's sights of the Altay tank. Optical designs of all E/O systems belong to Aselsan, and the company also carries out reflective and refractive optical design activities for short (SWIR), medium (MWIR), long (LWIR), visible, and ultraviolet (UV) wavelengths. Aselsan also designs spherical, aspherical, and holographic lenses, single, multifocal, and afocal lenses, and carries out computer-aided performance analysis and tests of optical systems. Within the scope of optomechanical technologies, Aselsan designs structural elements, focus mechanisms, motors and gears, and position control sensors, as well as optical components such as lenses, mirrors, and prisms.

Providing laser solutions for nearly 20 years, Aselsan designs and manufactures APLD (Ambient Pressure Laser Desorption) sensor chips and laser modules used in cavity and gimbal systems independently of export permits, ITAR (International Traffic in Arms Regulations), and BAFA (Federal Office of Economics and Export Control) procedures. Aselsan also works on laser imaging, DIRCM (Directional Infrared Countermeasures), and laser defense systems. Various image processing algorithms used in electro-optical systems have been patented or indigenously developed by Aselsan in line with user needs. (Such as Dehaze, Edge Enhancement, Color Correction, Auto-White Balance and Image Sharpening for daylight camera and Non-Uniformity Correction [NUC], Bad Pixel Replacement [BPR] and Enhancement [IOP] for thermal cameras). Moreover, Aselsan uses machine learning to eliminate the image defects that affect the performance of the E/O systems. Thanks to the very complex Scene-Based NUC algorithm used in CATS, ASELFLIR-F500C, and ASELPOD systems, system-related or image-affecting defects can be isolated automatically after a certain learning period.

Aselsan CATS (Common Aperture Targeting System)

CATS consists of a 640x512 MWIR (Medium-Wave Infrared) Focal Plane Array camera with 15 µm (micron) pixel pitch operating at a 3-5 µm infrared wavelength, 1920x1080 HD daylight camera, 640x480 EMCCD (Electron Multiplying Charge-Coupled Device) low-light near-infrared (LL-NIR) camera, laser designator (LD), laser rangefinder (LRF), laser illuminator, and laser pointer. CATS has a 220 mm diameter Common Aperture, which is the 'primary' optical lens of the thermal, daylight, and low-light cameras. The 640x512 MWIR detector has a 15 µm pixel pitch and 60x optical magnification capability, which is considerably higher than its counterparts. While many equivalent products have a narrow field of view (FOV) of 1°, CATS has a much narrower FOV, such as 0.5°. In addition to 0.5°, 0.9°, 3.2°, narrow FOVs, CATS also has 30° wide FOV to provide wide-area surveillance. Aselsan plans to add two more FOVs between 3.2° and 30° in the near future. After the embargo in 2020, a much more efficient dual-gain detector started to be used without changing the sensor resolution of the existing detector. This detector is an Indium Antimonide (InSb) based detector instead of MCT (Mercury Cadmium Telluride) and provides far greater advantages over other sensors in parameters such as counter-efficiency and NFTD. The Daylight TV

Aselsan CATS

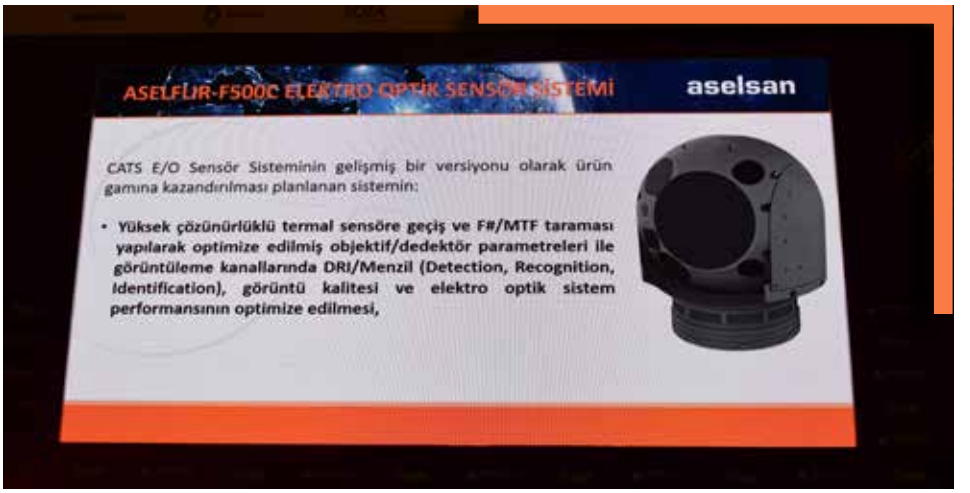
Camera has 1920x1080p HD resolution, and all the camera modules integrated into the CMOS (Complementary Metal Oxide Semiconductor) detector were designed by Aselsan. The sensors of the daylight and thermal cameras are procured from foreign sources, while all the optical and optomechanical elements, electronic cards, controller cards, and image processing cards belong to Aselsan. The Low-Light NIR camera has 640x480 resolution and 60x optical magnification capability. All cameras feature 2x and 4x continuous digital magnification.

The laser designator is one of the most critical components of CATS, and it is entirely designed by Aselsan, including the optical cavity. It uses a Diode-Pumped Nd:YAG laser designator module operating at a wavelength of 1064 nm. It has a range of 25 km (± 5 meters) with a high output power (100 millijoules/mJ and above). The Laser Designator is compatible with all NATO STANAG 3733 PRF codes and national code; hence it can be used with all NATO standard laser-guided munitions. The LD has a Repetition Frequency of up to 20 Hz (Band 1 and Band 2). Since May 2020, the "beam divergence value" of the Laser Designator was improved by Aselsan, and the effective range at which laser-guided munitions could be designated was further increased. The beam divergence value, which was 0.5 milliradians (mrad) in the initial production models, has decreased to 0.3 mrad in the current serial production models (0.3 mrad causes a beam diameter of 3 meters at about 10 km. 0.5 mrad is 5 meters at 10 km). The Laser Rangefinder (LRF) has a range of 30 km and has been verified in the field. It has an accuracy of ± 5 meters and has pulsed or continuous measurement capability. The Laser Pointer operates at 808 nm wavelength and is compatible with the low-light camera on CATS and the night vision goggles of friendly forces. The Pointer has a range of 20 km and an output power of 150 milliwatts (mW); its

divergence value is about 1 mrad (10 meters at 10 km). The Laser Illuminator module can illuminate targets up to a range of 2 km at low and medium altitudes. It also operates at 808 nm wavelength and is compatible with the low-light camera on CATS and the night vision goggles of friendly forces. The operating temperature of CATS is between -54°C and +50°C, and the storage temperature is between -55°C and +70°C. According to Cihan PİRİMOĞLU, the first serially produced CATS units have been delivered both in Turkey and abroad this year, and the system is actively used by the Turkish Armed Forces (TAF) and friendly nations. Although the CATS deliveries continue, the system is still being improved, so the verification work for its final configuration is still ongoing and it is expected to be completed soon.

ASELFLIR-F500C E/O System

Aselsan started to work on the ASELFLIR-F500C E/O system, an advanced version of CATS, in 2020. With the new project, Aselsan aims to upgrade the thermal sensor, image processing pipeline, and hardware, reduce the overall weight, and optimize the general E/O system performance. Aselsan started developing the ASELFLIR-F500C system this year with its experience from CATS and its access to HD sensors. Developed with Aselsan's own resources,

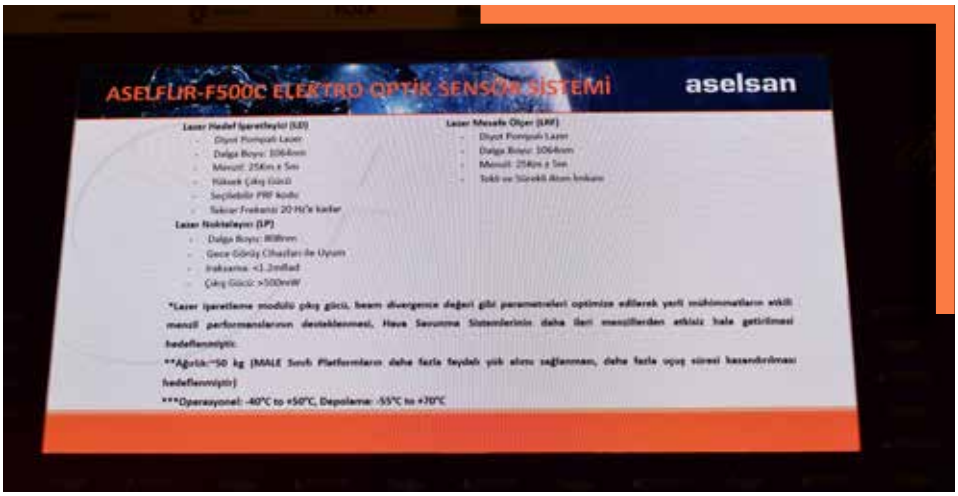


the system will be used in UAV/UCAVs such as TB-2 and ANKA-S and fixed-wing aircraft and attack helicopters. The most important advanced feature of the ASELFLIR-F500C system compared to CATS is the HD thermal sensors. With optimized lens/detector parameters (F#/MFT), Aselsan aims for a better DRI (Detection, Recognition, Identification) range in imaging channels, improved image quality, and optimization of E/O system performance. To better support the increased effective ranges of domestic munitions and neutralize air defense systems that pose a threat to UAV/UCAV systems from longer distances, Aselsan has updated and changed the laser modules. A new laser module with higher output power and lower beam divergence will be integrated into the ASELFLIR-F500C system. Unlike CATS, the ASELFLIR-F500C system is aimed to be used on all platforms thanks to the improved gimbal design (tactical and MALE class UAV/UCAVs, attack helicopters, and fixed-wing aircraft).

In summary, Aselsan aimed to provide a single gimbal solution for various aircraft types used by the TAF and allied nations. Since the ASELFLIR-F500C system is still in the design phase, it will first be used in unmanned aerial vehicles. After the preliminary design activities are completed, it is planned to be used on HÜRKUŞ, ATAK-I Phase 3, and ATAK-II.

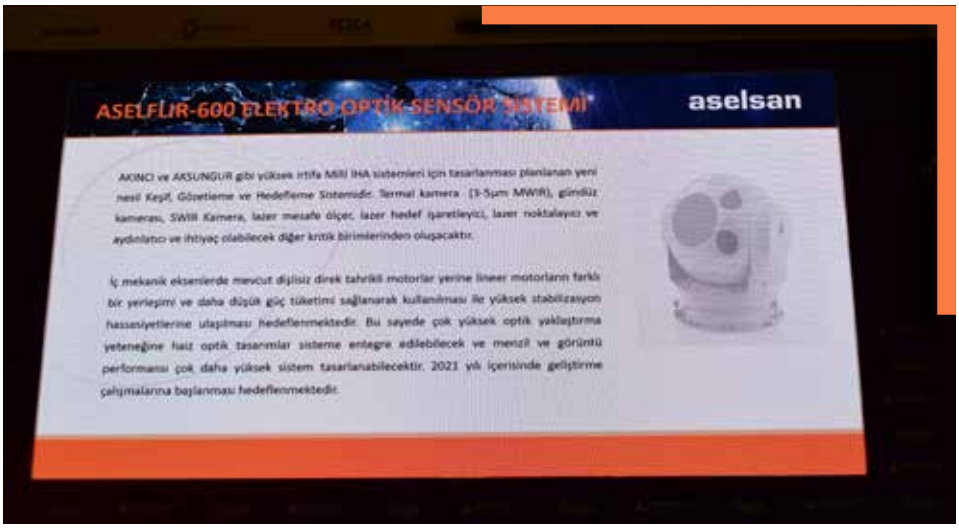
ASELFLIR-F500C system consists of a 1280x1024 HD MWIR (Medium-Wave Infrared) Focal Plane Array camera with 15 µm pixel pitch operating at 3-5 µm infrared wavelength, 1920x1080p HD daylight camera, 1280x1024 HD SWIR (Short-Wave Infrared) camera with 10 µm pixel pitch operating at 0.9-1.7 µm infrared wavelength, Laser Designator (LD), Laser Rangefinder (LRF), and Laser Pointer. Like CATS, ASELFLIR-F500C will feature a Common Aperture for the MWIR, daylight, and SWIR cameras. While the equivalent products can only view the laser spot with their low-light cameras under certain environmental conditions, with the SWIR integration, ASELFLIR-F500C is intended to see the laser spot on all imaging channels (daylight, MWIR, SWIR). ASELFLIR-F500C is planned to weigh around 50 kg, 6-7 kg lighter than the 56 kg CATS system. The operating temperature of the system is between -40°C and +50°C, and the storage temperature is between -55°C and +70°C. Like CATS, it also uses a 1064 nm Diode-Pumped Nd:YAG laser designator with a range of 25 km (± 5 meters). The LD has selectable PRF (NATO STANAG 3733 PRF codes and national code) capability and Repetition Frequency of up to 20 Hz (Band 1 and Band 2). The Laser Pointer operates at 808 nm wavelength and is compatible with the night vision goggles (NVG) of friendly forces. Aselsan aims to increase the pointer output from 150 milliwatts to 500 milliwatts and reduce the divergence value below 1.2 mrad. The preliminary and detailed design phases of the ASELFLIR-F500C system will be completed in 2021, and the serial production phase is expected to start in 2022.

In addition, Aselsan has started the 'New Generation Gimbal Development Project' with its own resources with the experience from the CATS project. The project was initiated to bring linear motor technology, which will provide structural advantages to Aselsan gimbal systems. It focuses on optimizing weight, increasing stabilization capabilities, and transitioning to different system architecture. Within the scope of the project, which is planned to be implemented into the systems in approximately 2 years, Aselsan aims to reduce weight, increase the mechanical stabilization performance in 4 axes, reduce connection parts, change the mechanical architecture that affects the control range, reduce the brush friction, and increase the effective internal volume. To further improve the 5 µrad sensitivity of CATS and increase the stabilization performance on platforms that are exposed to heavy vibration, such as attack helicopters, Aselsan plans to switch to linear motors on the inner axes and geared motors on the outer axes. By switching to gear motor structure in the ASELFLIR-F500C system, Aselsan aims to increase the wind load resistance of gimballed systems used in fixed-wing platforms at high speeds such as 300-350 knots. Ultimately, Aselsan intends to use linear motors on the inner axes of all gimballed systems and gear or direct-drive motors on the outer axes depending on the platform on which the E/O system will be mounted.



ASELFLIR-600 E/O System

The latest product introduced at the "Aselsan Electro-Optical Solutions" presentation was the ASELFLIR-600 system, a new generation reconnaissance, surveillance, and targeting system designed for high-altitude long-endurance (HALE) national UAV/UCAV systems such as Akıncı and Aksungur. The preliminary design of the system will start this year, and it is planned to be launched as an official development project with Aselsan's own resources after the completion of initial analysis. In this context, Aselsan works together with the SSB and UAV platform manufacturers to determine system specifications. CATS and ASELFLIR-F500C have a gimbal diameter of 15 inches, while the ASELFLIR-600 is planned to have a diameter of 22 inches. ASELFLIR-600 system will consist of critical modules such as 1280x1024 HD MWIR camera with 15 µm pixel pitch operating at 3-5 µm infrared wavelength, 1920x1080p or higher resolution daylight camera, SWIR camera, Laser Rangefinder, Laser Designator, and Laser Pointer. ASELFLIR-600 aims to achieve high stabilization by using linear motors instead of the existing gearless direct-drive motors on the inner axes. In this way, Aselsan plans to achieve superior range and image performance by integrating optical designs with very high magnification capability into the system. Aselsan also intends to increase the laser output and decrease the beam divergence by increasing the internal space allocated to the laser modules thanks to the enlarged and optimized gimbal structure. Lastly, after acquiring critical sensor technologies in-house and starting serial production, Aselsan has recently begun to develop a new product between the 15-inch and mini gimballed systems for short-range/tactical UAV platforms



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Increasing Its Operational Capability, Replenishment at Sea (RAS) Capability is a Significant Force Multiplier for the Turkish Naval Forces

by İbrahim SÜNNETÇİ

"The one who rules the seas, rules the world" is a well-known quote attributed to Barbaros Hayrettin, Grand Admiral of the Turkish Fleet in the 16th Century. The main point, which we would all agree upon, is that Sea Power is today, and will be in the future, at the core of world order. The one who dominates the seas rules over the world, and nations who best utilize this potential, dominate the global system.

Turkey lies where three continents meet. Surrounded by three seas from the North (Black Sea), South (Aegean Sea) and West (Mediterranean Sea) Turkey has a coastline that spanning 8,484km. Its geo-strategic position and geopolitical situation obliges Turkey to be a maritime state and dictates it to have and sustain a powerful Naval Force.

In order to adapt to changing security environments the Turkish Naval Forces (TNF) has been continuously transforming, restructuring its organizational structure and carries out new tasks against the challenges of the new security environment, while maintaining and enhancing its conventional naval capabilities. The force and command structure of the TNF now provide the essential elements to perform both conventional naval tasks as well as constabulary ones.

The TNF's primary mission is to defend the country against all maritime threats and risks and to protect its maritime interests both in times of peace and crisis while contributing to the maintenance of peace and stability in the region. In this context, in peace and crisis, the main tasks of the TNF are as follows:

- Peace Support Operations
- Search & Rescue Operations
- Participation in Humanitarian Assistance & Disaster Relief Operations
- Constabulary Operations
- Protection & Control of Maritime Jurisdictional Areas
- Non-Combatant Evacuation Operations
- Presence & Flag Show
- Sea Control & Sea Denial Operations
- Protection of Sea lanes of Communications and
- Power Projection

In order to effectively execute those tasks, the Turkish Naval Forces Command (TNFC) is organized into four major subordinate commands, which includes Fleet Command (Golcuk, Kocaeli), Northern Sea Area Command (Istanbul), Southern Sea Area Command (Izmir) and Naval Training & Education Command (Istanbul). As part of on-going transformation efforts starting from 2011 within Fleet Command three separate Task Group Commands (namely North, South and West)

have been formed. And finally, in 2015 in order to assure coordination and cooperation among those three Task Group Commands, the War Fleet Command (covers frigates, corvettes and fast patrol boats) was established and subordinated to the Fleet Command. Today, the Fleet Command, which constitutes the striking power of the Turkish Naval Forces, is the largest of the naval components and consists of: War Fleet Command (Golcuk, Kocaeli), Submarine Fleet Command (Golcuk, Kocaeli), Mine Fleet Command (Erdek, Balıkesir), Turkish Logistic Support Ship Division (Golcuk, Kocaeli), Naval Supply Center Command (Golcuk, Kocaeli), Turkish Naval Forces Inventory Control Centre Command (Golcuk, Kocaeli) and Naval Aviation Command (Cengiz Topel, Kartepe/Kocaeli). Major Naval Bases of the Turkish Naval Forces are located at Golcuk (Main Base) and Erdek in the Sea of Marmara and Aksaz and Foca in the Aegean Sea. There are also naval bases in Bartin, Karadeniz Ereglisi and Trabzon (Camburnu, under construction) in the Black Sea, in Mersin and Iskenderun in the Mediterranean Sea, and at Istanbul and Canakkale in the Bosphorus and Dardanelles straits. As one of the most respected, powerful, and capable navies in the Mediterranean the TNF currently has Naval Air Bases at Cengiz Topel Kartepe, Canakkale and Dalaman.

TDGG A-580 RAS with TCG Giresun

The TNF, with increasing effectiveness and synergy with other services and allies, is presently capable of conducting both Brown and Blue Water Operations. Today, the warships of the TNF wave the Turkish flag with great pride on the world seas from the Sea of Japan to the Baltic Sea, from the Persian Gulf to the Somali Basin, from Gibraltar to Panama, and from the North Atlantic to the Indian Ocean.

The TNF main surface fleet currently consists of 8 GABYA Class (ex FFG-7 OHP Class), 4 MEKO 200 Track I (YAVUZ Class) and 4 Track IIA and Track IIB (BARBAROS Class) Frigates along with 6 BURAK Class (ex A69 Aviso Class Corvettes) and 4 ADA Class Corvettes and 19 Fast Patrol Boats (4 DOĞAN Class, 4 RÜZGAR Class, 2 YILDIZ Class, 3 KILIÇ-I and 6 KILIÇ-II Class). As of March 24, 2021, the TNF's submarine fleet consists of 4 AY Class, 4 PREVEZE Class and 4 GÜR Class Submarines. The deliveries of Type 214TN REİS Class Submarines will be completed during 2022-2027. Contracts have already been signed for the Test and Training Vessel (TVEG), İSTANBUL/İSTİF Class Frigates and TCG Anadolu (L-400) Multipurpose Amphibious Assault Ship (LHD), and construction efforts have been launched. Meanwhile the contract for the TF-2000 Air Defence Warfare (ADW) Destroyer Program is expected to be awarded by the mid-2020s.

The current efforts to renew the fleet with 4 new ISTIF Class frigates (the first TCG Istanbul [F-515] class is planned to enter TNF service on September 6, 2023), a test and training ship TCG Ufuk ([A-591] to be commissioned in 2021 and as the first intelligence [ELINT/SIGINT] ship of Turkey, she will act as "Turkey's Eyes and Ears" in the Seas), 6 new generation AIP submarines (first of them TCG PiriReis [S-330] will be inducted into TNF service in 2022), Mid-Life Upgrade (MLU) of existing PREVEZE Class (Type 209/1400) Diesel-Electric Submarines and BARBAROS Class frigates, a 27,000 tons Multi-Purpose Amphibious Assault Ship (LHD) TCG Anadolu on which helicopters and UAVs/UCAVs will be deployed (scheduled to be commissioned in late 2022), a 22,000 ton Replenishment At Sea & Combat Support Ship (DIMDEG) TCG Derya (to be commissioned in 2024), 2 Logistic Support Vessels (expected to be inducted into TNF service in 2021 and 2022) and 2 (+2 optional) new Replenishment Tankers, indicates that Turkey wants to be even stronger in the high seas when far from the homeland.

Supporting of counter piracy operations on the coasts of Somalia and the Gulf of Aden, under the framework of the United Nations Security Council (UNSC) and the Grand National Assembly of Turkey (TBMM) since 2009 and touring the African continent with a BARBAROS Turkish Naval Task Group, these activities in 2014 were in essence the first sign that the Turkish Naval Forces (TNF) demonstrated that they wanted to be in the oceans, which was the primary motivation for the on-going new ships, submarines and missile projects that were launched to build future naval forces.

Turkish Naval Task Group

The "Turkish Naval Task Group (TDGG)" concept started in 2010 as a result of the "Open Sea" policy of the TNF. The Turkish Naval Task Group performed its first activation from May 10 - July 5, 2010, and this was one of the concrete indicators of transformation in the Turkish Naval Forces Strategy.

The Turkish Naval Task Group, which comes into view as a first initiative in history of TNF has been established as a high seas task group formed to operate in geographies far from homeland. The Turkish Maritime Task Group not only demonstrates the transformation in the TNF but also its determination to continue this transformation. From this point of view, it can be described as the implementation of the strategy focusing on the high seas. In the 2030s, when new platforms such as ISTIF Class Frigates, TCG Anadolu and her sister ship TCG Trakya LHDs, TCG Derya DIMDEG, TF-2000 Air Defence Destroyers and MILDEN Submarines are included in the inventory, the TNF is expected to establish an Open Sea Task Force.

The Turkish Naval Task Group, which does not have a permanent headquarters and force structure, performed its following activation in 2011, 2014, and in 2019/20. The TDGG operates in different regions during each activation period. In this context, it operated in the Mediterranean in 2010 (performed port visits in 9 countries), in the Red Sea, the Gulf of Aden, the Somalia Basin, the Arabian Sea and the Indian Ocean in 2011 (performed port visits in 8 countries), and the group travelled around the African continent in 2014. BARBAROS Turkish Naval Task Group, that deployed to the African Continent during March 17 and June 27, 2014 comprised of 2 frigates (TCG OruçReis and TCG Gediz), 1 corvette (TCG Heybeliada) and 1 fleet replenishment ship (TCG Yarbay Kudret GUNGOR). During this mission the BARBAROS Turkish Naval Task Group performed 25 port visits to a total of 24 countries (19 of these countries were visited for the first time by Turkish Naval units) on the African continent.

A-580 TCG Akar prepares for a RAS mission

Starting from December 26, 2019 the Turkish Naval Task Group was tasked to provide ancillary support to Turkey's 'Operation Mediterranean Shield' and 'NATO's Operation Sea Guardian' as well as to demonstrate a presence & wave the flag in the Central Mediterranean Sea. Within the scope of this mission the Turkish Naval Task Group was activated four times during December 26, 2019 and October 1, 2020 under the command of the Southern Task Group Commander (December 26, 2019 – March 7, 2020), the Northern Task Group Commander (March 7, 2020 – July 16, 2020), the Western Task Group Commander (July 16, 2020 – August 25, 2020), and the Commodore of the 2nd Corvette Flotilla (August 25, 2020 – October 1, 2020) respectively. Since October 1, 2020 the mission was carried out by 2 frigates under the command of the Commodore of the 5th Destroyer Flotilla.

The Fleet Replenishment Ships of TCG Akar (A-580) and TCG Yarbay Kudret GUNGOR (A-595) that belong to the Turkish Logistic Support Ship Division based in Golcuk, Kocaeli supported the Turkish Naval Task Group during activation. However, due to their low constant cruising speeds (at 13kts) they could not keep pace with the frigates they escort, and this caused the Turkish Naval Task Group to navigate at a slower speed. Taking lesson from this experience, the TNF has requested the DIMDEG ship to have a higher cruising speed than the existing replenishment ships in the inventory.

Replenishment at Sea (RAS) & TNF's Logistic Support Ship Programs

Given the realities of Turkey's geostrategic situation and the TNF's recent strategy and priorities, an afloat support capability is essential. Replenishment at sea (RAS, NATO) or underway replenishment (UNREP, US Navy) is a method of transferring fuel, munitions, and stores from one ship to another while holding a steady course and speed, generally between 12 and 16 knots. The ability to replenish warships at sea enables them to be on task for extended periods, which also significantly enhances their operational capability and flexibility. As a significant force multiplier RAS capability extends the range and sustainment of both surface combatants and amphibious vessels with embarked land forces.

RAS Ships provide greater reach and endurance and allow self-reliant and sustained operations to be conducted away from an onshore support base. This

afloat support capability, which enables warships to provide an on-going presence and an immediate response to a developing situation, is vital for the TNF and Turkish Naval Task Group. Without an afloat support ship to replenish fuel and other essential consumable stores the TNF's surface units are restricted to operating at distances no greater than their half-range from support. To achieve extended periods at sea, surface combatants/units must either have access to closer shore support or be accompanied by a replenishment ship. As demonstrated by the Turkish Naval Task Group, with suitable replenishment ships and the ability to resupply at sea, surface combatants/units can remain on station for weeks at a time. As a general indication, a surface combatant supported by a replenishment ship is limited only by crew rest considerations. In addition to their primary role of supporting maritime task groups in both open water and littoral operations, replenishment ships are also critical joint logistic assets. RAS Ships are not, however, just tankers. They are a 'one-stop logistic shop' and must carry several different cargoes concurrently to provide the full range of afloat support to surface combatants and task groups to increase both their range and sustainability. This not only includes diesel fuel, aviation fuel, oil, and lubricants, but also dries stores including food, refrigerated and frozen stores, general stores and spare parts, water, and ammunition.

Although the acquisition of new surface combatants and amphibious ships is important, being able to support them as part of the TNF's capability to deploy locally, regionally, and worldwide, is also of crucial importance. In this context, along with surface combatants, the TNF also launched projects to renew its logistics assets. The TNF intends to expand its logistics fleet by 2025 with the induction of a locally constructed 22,000-ton Replenishment at Sea & Combat Support Ship (DIMDEG) TCG Derya, 2 medium-sized Logistic Support Ships and 2 (+2 optional) new Replenishment Tankers. These new logistic support ships will assist the existing fleet of TCG Akar (A-580, entered service in September 1987) and TCG Yarbay Kudret Gungor (A-595, entered service in October 1995, the first ship ever built for the Turkish Navy by a private Turkish shipyard) Fleet Replenishment Ships and TCG Albay Hakki BURAK (A-571) and TCG Yuzbasi I. TOLUNAY Liquid Fuel Tankers.

TCG Derya Replenishment at Sea & Combat Support Ship (DIMDEG)

The DIMDEG Project has was launched meet the Turkish Naval Forces Command (TNFC)'s new generation Fleet Replenishment Ship requirement, to ensure fuel and water transport and supply needs are satisfied for surface units in the open seas around the world.

The project comprises two phases: Contractual Design and Detailed Design & Construction. The ship's initial design was carried out by the TNFC Design Project Office (DPO) located at the Istanbul Naval Shipyard, while some activities/tests required for the design phase were performed by STM under a contract awarded by the Presidency of Defence Industries (SSB) on October 1, 2012. For the Detailed Design & Construction Phase a tender was launched in May 2016 to select the main contractor and in May of 2016 the SSB received proposals from two Istanbul-based private shipyards, Sedef Shipyard and Sefine Shipyard. During the Defence Industry Executive Committee's January 31, 2018 meeting (DIEC, Turkey's top decision-making body on defence industrial procurement) Sefine Shipyard was selected under the DIMDEG Project and the SSB was given the green light to start contractual negotiations with the company. The DIMDEG Detailed Design & Construction Phase contract was signed between the SSB and Sefine Shipyard on June 28, 2018. According to the contract schedule, the TCG Derya Replenishment at Sea (RAS) & Combat Support Ship would be delivered to the TNF in the 58th month following the contract effective date.

On 25 January 2019 Sefine Shipyard signed a contract with Aselsan-Havelsan Business Partnership for the procurement and integration of combat systems (including Havelsan's ADVENT Combat Management System [CMS], Ship Data Distribution System, Ship Information System and Message Operating System as well as Aselsan's MAR-D

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A-595 TCG Yarbay Kudret GÜNGÖR Fleet Replenishment Ship

The CGI of DIMDEG Vessel

Surveillance Radar, 25mm STOP Stabilized Naval Gun System, IFF System, Integrated Communication System, KIRLANGIÇ EO/IR Reconnaissance & Surveillance System, SatCom System, and 2x GÖKDENİZ CIWS) for the DIMDEG.

The TCG Derya RAS & Combat Support Ship will be a multi-purpose replenishment ship (AOR), which effectively combines the functions of a fleet oiler and stores ship. The platform will be used for replenishment at sea of fuel, water, food, spare parts, medical supplies, and ammunition for the platforms of the TNF. TCG Derya DIMDEG will have an overall length of 194.8 meters, a height of 7.2 meters, displacement of 22,000 tons and a beam of 24.4 meters. To be powered by two gas turbines (LM2500, in June 2020 GE Marine received a contract from Sefine Shipyard to provide two LM2500 marine gas turbines for DIMDEG) and two diesel engines, the TCG Derya RAS & Combat Support Ship will have a maximum speed of 24 knots, endurance of 30 days (minimum) and a maximum range of 4,500nm. The ship will also have a large helipad that will allow for take-off and landing in day & night conditions and can refuel helicopters. Thanks to its dual enclosed hangar facilities, two multi-purpose helicopters up to 15 tons can be embarked on the ship. To be able to serve as a command-and-control ship, TCG Derya DIMDEG will feature two separate CICs. The first one is for combat management purposes, the second one with numerous OPDESKs (they are commercial products rather than military standard OPCONs) can serve as a Joint Operations Command Center or in case of a natural disaster as a Natural Disaster Management Center.

According to a SSB statement, issued on July 13, 2018 many Turkish companies, including Aselsan, Havelsan and Turkish Loyd will take part in the DIMDEG Project and the ship will be integrated with ADVENT Combat Management System. "The Industrial Participation and Offset (IP/O) commitment in the DIMDEG Project will be realized at over 77%" the Presidency said in a statement. The TCG Derya RAS & Combat Support Ship will be inducted into the TNF's service in 2024.

Logistic Support Ship Project

Covering the acquisition of two oil tankers from a local shipyard the Logistic Support Ship Project commenced in July 2012 to provide logistic support for the TNF's surface combatants deployed in the TNF's operational regions including the Marmara Sea, Black Sea, Aegean and the Eastern Mediterranean. The ships will provide combat support in terms of logistic support and will meet the liquid fuel (F-76 and JP-5), fresh water and food requirements of the surface combatants both at sea and ashore. Logistic Support Ships with their on-board capabilities can also support humanitarian aid and peace support operations.

Istanbul-based private shipyard Selah Shipyard was selected in May 2014 and the contact was awarded on November 4, 2014, with an advanced payment by the SSB which took place on November 24, 2014. According to the contract Logistic Support Ships should have been commissioned in 2018. Construction of the first Logistic Support Ship TCG Yuzbasi Gungor DURMUS (A-574), started in 2015 and the ship was launched on October 8, 2016 at Selah Shipyard. The second ship of the project, TCG Ustegmen Arif EKMEKCI (A-575) was launched on July 8, 2017.

In 2019 Selah Shipyard declared concordat due to the economic crisis and thus could not fulfil its commitments under the contract even though an agreement was made between the Turkish Naval Forces Command and Selah Shipyard for the delayed acceptance of the first ship TCG Yuzbasi Gungor DURMUS (A-574, which was stated to be 98% complete) in the Logistics Support Ship Project. During the second half of 2019 the SSB terminated the contract signed with Selah Shipyard under the Logistic Support Ship Project. In his opening speech at the 9th Marine Systems Seminar held at the METU Culture and Congress Center on October 14-15, 2019, Alper KOSE, Head of the SSB Naval Platforms Department, also shared information about the contract termination and said, "the Logistics Support

Logistic Support Ships at Selah Shipyard

Ship contractor declared concordat because of financial problems. We terminated the contract, but we will continue the project. So, there will be no loss in the project, there is a delay, but we will continue." The SSB selected Savunma Teknolojileri ve Muhendislik Ticaret A.S. also known as STM for the completion and delivery of the Logistic Support Vessels. According to the current schedule TCG Yuzbasi Gungor DURMUS (A-574) will be delivered in 2021 and TCG Ustegmen Arif EKMEKCI (A-575) will be delivered in 2022.

With a displacement of 8,744 tons at full load, the 105.44 meter long Logistic Support Ships' maximum speed would be over 12 knots and could reach 9,500nm at full load displacement, sea state 2. Equipped with conventional all diesel-CPP propulsion system, the Logistics Support Ships are powered by two diesel engines each generating 1,520kW. The Logistics Support Ships can complement a crew of 60 (53+12) personnel and are able to perform helicopter operations at Sea State 4 and fuel supply at Sea State 5. Featuring enough provisions for 30 days at sea, the Logistic Support Ships are fitted with Astern Fuelling Systems (AFS), which are capable of transporting fuel to a vessel sailing behind the replenishment vessel and able to carry 8 ISO containers.

The vessels have a capacity to hold 4,036 tons of F-76 diesel fuel, 336 tons of helicopter fuel (F-44/JP-5) and 594 tons of freshwater and at least 108m3 of food/meals. The platform is a mono-hull type vessel, all-steel construction, designed to meet speed, sea keeping manoeuvrability and stability requirements. The expected service life of these vessels is 30 years. The ships will have unlimited operation capability up to sea state 5 and will be operable with some limitations in sea state 6 or higher. The ships have 100% redundancy for critical systems and fully air-conditioned accommodations and provide Full Monitoring and Control of major ship systems from MCR and damage control stations, automatic stability and loading control system. For self-protection, the vessels will be armed with a pair of Aselsan 12.7 mm Remote Controlled Stabilized Machine Gun Systems (STOP). The ships also have a large helicopter deck that allows for take-off and landing and the refuelling of helicopters. The helipad allows day and night helicopter take-off and landing and is designed to support multi-purpose helicopters up to 15 tons. The ship has a hydraulic crane, which has a lifting capacity of 18 tons and an electrical crane, which has a lifting capacity of 2 tons.

Replenishment Tankers for Fast Attack Craft

Under the Replenishment Tankers Procurement Project, on December 9, 2020 the SSB issued a Request for Proposal (RFP) document to local shipyards for the procurement of 2 (+2 optional) new Replenishment Tankers along with spare parts, training service and related documents. According to the RPF document bidders should submit their proposals by March 15, 2021. According to the RFP, the main mission of these ships would be to meet liquid fuel requirements of Fast Attack Craft (FAC) in a safe and rapid manner in a possible naval operation and/or war, while they are in a waiting/hiding place. The Turkish Navy's Albay Hakkı BURAK Class liquid fuel tankers TCG Albay Hakki BURAK (A-571) and TCG Yuzbasi I. TOLUNAY are currently providing afloat fuel support capability for the FAC in TNF service. Speaking at Defence & Technology Days event organized by ITU SAVTEK on March 24, 2021, Alper KOSE, Head of the SSB Naval Platforms Department disclosed that the SSB will soon launch a tender for the procurement of Replenishment Tankers Procurement Project


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TurAF to Replace KC-135R Stratotankers with A330 MRTT Aircraft

by İbrahim SÜNNETÇİ

The veteran KC-135R Stratotanker Tanker Aircraft in the inventory of the Turkish Air Force (TurAF) is expected to be replaced with the new generation A330 Multi Role Tanker Transport (MRTT) Aircraft from Airbus Defense & Space (ADS) in the coming years. The A330 MRTT was one of two candidates evaluated as part of the TurAF's need for a New Generation Tanker Aircraft.

According to the information I have received, concrete progress has been made in the negotiations that started with Airbus Defense & Space in 2020, and it is said that the green light for the project may be given in the summer of 2021 (July/August).

Within the scope of the project, which will be carried out under the coordination of ASFAT (Military Factory and Shipyard Management Inc.) within the Turkish Ministry of National Defense (MoND), a total of 7 A330 MRTT Aircraft are expected to be delivered to the Turkish Air Force, to replace the 7 KC-135R Stratotankers in the inventory on a one-to-one basis. According to my sources, there is a plan to procure the planes in 2+5 as part of Turkey's higher business package demand. Although the A330 MRTT Aircraft has a higher fuel and personnel/cargo carrying capacity compared to the veteran KC-135R Stratotanker Aircraft (it is estimated that missions performed with 7 KC-135Rs today can be performed with 4 or 5 A330 MRTTs) the A330 MRTT can be sufficient, I assess that the two important factors in determining the number of A330 MRTTs as 7 are the increasing workload of the TurAF due to Turkey's military presence (base/units) in 15 countries around the world, including Syria, Libya, Qatar, Somalia, Iraq, Azerbaijan, and Sudan to ensure its own national security and international missions under the NATO or UN umbrella, and the potential for the emergence of different unforeseen missions and configurations for the A330 MRTT Fleet. The A330 MRTT has sufficient spare capacity to take advantage of new digital technologies and can be fitted with a wide range of sensors to enhance its features beyond air-to-air refuelling and strategic air transport.

According to the current plan, in the first phase, ASFAT will select 7 aircraft with the lowest engine flight hours among the A330-200 widebody passenger airliner in the Turkish Airlines (THY) Fleet on behalf of the MSB (there are 14 A330-200 aircraft with GE CF6-80E1 engines in the THY fleet). Then, the first plane will be ready for the MRTT conversion with preliminary work expected to take 6 months (for example, the paint on it will be wiped, and the seats in the cabin will be removed). With the help of technical support and related documents from Airbus, structural transformation work on the aircraft is expected to be carried out at the 2nd Air Maintenance Factory Directorate (2nd AMFD, former 2nd Air Supply Maintenance Center [ASMC], the name of facilities was changed to the 2nd Air Maintenance Factory Directorate in March 2017).

The first A330-200 aircraft, which will be transformed into a "green aircraft" within the 6-month preparatory work, will then be sent to Airbus Defense & Space's facilities in Getafe located 20km south of Madrid, the capital of Spain, for the MRTT structural transformation (conversion) work that is expected to take 12 months. A certain number of Turkish personnel will also participate in the structural transformation work on the first aircraft at the Getafe facilities and receive on-the-job training. Although not certain at this stage, it is stated that in case of demand, the MRTT structural transformation work on the second A330-200 can also be carried out at the Getafe facilities, but there is a definite plan for the structural transformation work on the other 5 aircraft to be carried out in Turkey.

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During the MRTT conversion process of each the A330-200 aircraft, some 16,000 types of new components will be installed and approximately 450 new electrical harnesses (for a total cabling length of more than 50 km), as well as 6,000 brackets and 1,700 connectors. TurAF A330 MRTTs are believed to have the ability to refuel both probe and receptacle-equipped aircraft and to be able to receive fuel as well.

It is said that the company Turkish Technic, which provides maintenance and repair services to A330-200 aircraft, including their avionic systems, may also take part in the structural transformation studies. The company Airbus Defense & Space will provide the necessary technical and know-how support for the preliminary preparation and structural transformation work to be carried out on the aircraft. The subsystems to be integrated into the plane under the MRTT transformation work will also be procured from ADS. If the project is implemented, the MRTT conversion work of A330-200 aircraft will be carried out in Turkey for the first time after the UK. As may be remembered, the transformation process of the first 2 FSTA Voyager Tanker/Transport Aircraft under the Royal Air Force (RAF) Future Strategic Tanker Aircraft (FSTA) Program (14 aircraft in total) was carried out in Getafe, Spain, in 2009 and 2010; while the 3rd and 4th planes were converted at Cobham Aviation Services' facilities in Bournemouth, England. However, due to the delay in the process and the RAF's decommissioning of the venerable VC-10 and Tristar tanker aircraft in 2013, it was decided to also transform the other 10 A330-200 aircraft in Getafe.


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TurAF's 10th A400M Aircraft Planned for Delivery in January 2022

As may be remembered, under the A400M Aircraft Retrofit Contract signed between Airbus Defense & Space and ASFAT on October 3, 2019, the retrofit work of the first A400M Aircraft (MSN-009/13-0009) was started in December 2020 at the 2nd AMFD, which is the authorized maintenance center for the A400M aircraft. The retrofit work, which includes software and hardware upgrades, is expected to be completed in July 2021, and the preliminary work for the second aircraft (MSN-013/14-0013) is expected to begin. Following the retrofit process, the 9 A400M Aircraft in the TurAF inventory is planned to reach Full Operational Level (FOL) by 2023/2024. It is stated that the TurAF A400M Fleet has an overall mission capable rate of 85%. Since the 10th A400M aircraft to be delivered in January 2022 will already be in the latest software and hardware configuration, it will not undergo the retrofit process. Retrofit work is being carried out in the newly built private aircraft hangar with a construction area of 10,000 m^2 and a height of 24 m equipped with high-tech protection equipment, and the second hangar is expected to be completed soon. According to the information I have received, the preliminary preparation and structural transformation of the A330 MRTTs will be carried out in this hangar.

The Airbus A330 Multi Role Tanker Transport (MRTT)

Based on the Airbus' popular A330-200 widebody passenger airliner, the A330 Multi Role Tanker Transport (MRTT) Aircraft can carry 111 tons (245,000lb) of fuel on its wide wings and tail. Thanks to this feature, no modification is required in the fuselage to load the fuel tanks onto the aircraft. As all fuel is carried on the wings and tail, the A330 MRTT can carry up to 45 tons (99,000lb) of additional cargo in the cabin. Being the only new generation tanker that can carry 111 tons of fuel without auxiliary fuel tanks, the A330 MRTT is capable of performing three different tasks in one mission with zero turnaround time (Air-to-Air Refueling [AAR], Passenger/Military Personnel/VIP Transport and Aeromedical Evacuation [AME]). Promoted as the only new generation tanker aircraft solution in the market that offers true multi-role capabilities in this respect, the A330 MRTT can refuel 82.2 tons at a range of 500nm (926km). With 64,000kg (140,800lb) of fuel, the A330 MRTT can perform an AAR mission at 500nm for 5 hours, or for 4 hours and 30 minutes at 1,000nm (1,852km) with 55,000kg (121,000lb) of fuel. The A330 MRTT can provide fuel to 4 fighter/bomber aircraft without an external weapon load up to a range of 3,600nm (6,700km, with a 25 tons cargo load, this distance is 2,800nm [5,200km]). Additionally, it can transport 266 passengers or 130 NATO standard stretchers in a two-class configuration or 300 passengers with their personal belongings in a single-class layout to intercontinental distances at a high speed, comfortably. As part of the Strategic Transport Mission, the A330 MRTT can ferry 40 tons (88,000lb) of cargo and 300 troops with military equipment to a distance of 8,400km (4,500nm), 30 tons (66,000lb) of cargo, and 200 rescue personnel with their equipment to a distance of 10,200km (5,500nm) and,

from the danger zone, it can transport 250 evacuees with 20 tons (44,000lb) of cargo to a distance of 12,000km (6,500nm).

The A330 SMART MRTT, the new version of the A330 MRTT with Automatic Air-to-Air Refueling (A3R) capability, can also be used as a communication node and command & control aircraft apart from air-to-air refueling and transport missions with its Link 16 Tactical Data Link and Broadband SATCOM capability.

As of June 2021, a total of 61 A330 MRTT have been ordered, 47 of which have been delivered. The A330MRT Fleet has over 250,000 flight hours in service. The A330 MRTT Aircraft currently in service with the Royal Australian Air Force (RAAF, 7 aircraft), the Royal Saudi Air Force (RSAF, 6 aircraft), the UAE Air Force (3 aircraft), the Royal Air Force (RAF, 14 aircraft), the Republic of Singapore Air Force (RSAF, 6 aircraft), the French Air Force (12 aircraft) and the Republic of Korea Air Force (ROKAF, 4 aircraft), as well as the NATO/NSPA Multinational MRTT Squadron (NATO Support and Procurement Agency, 9 aircraft, Royal Netherlands Air Force, Luxembourg Armed Forces, German Air Force, Royal Norwegian Air Force, Belgian Air Force and Czech Air Force).

With a total length of 58.80m, a height of 17.40m, and a wingspan of 60.3m, the A330 MRTT Aircraft has a Maximum Take-Off Weight (MTOW) of 233 tons and a Maximum Landing Weight (MLW) of 182 tons. With a maximum payload/cargo capacity of 45 tons (99,000lb), the aircraft is powered by General Electric (GE) CF6-80E1A3 (320kN) or Rolls-Royce Trant 772B (316kN) engines. In addition, the A330 MRTT can be equipped with three different refueling systems, which allow aircraft with different probes to be refueled in the air: two underwing refueling pods (Cobham 905E, for aircraft with probe-and-drogue capability such as F-35 and F/A-18, 1,800kg/min fuel transfer rate), the Fuselage Refuelling Unit (FRU, Cobham 805E, for large aircraft with hose-and-drogue capability such as A400M, 1,300kg/min fuel transfer rate), and the Aerial Refueling Boom System (ARBS, for aircraft with refueling port/receptacle such as F-16). Defined as the "21st-century benchmark for new generation tanker/transport aircraft," the A330 MRTT can transfer 100 liters of fuel per second and 3,600kg (1,200 gallons/min) of fuel per minute with the Aerial Refueling Boom System (ARBS) with a fly-by-wire system.

The Aerial Refueling Console, where fuel transfer is controlled, is located just behind the cockpit (also in the same position on KC-46A), unlike other tanker aircraft in service. The operator manages the refueling process remotely, thanks to cameras with day and night vision capabilities. With the ARBS, two engines backing up each other are used to increase the safety of refueling, and even if one of the engines fails, the system can complete its task with a single engine (although the fuel transfer rate is slightly reduced). Furthermore, thanks to the Universal Aerial Refueling Receptacle Slipway Installation (UARRSI), the A330 MRTT can also refuel from another MRTT/tanker aircraft to increase its flight range.

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Boeing KC-135 Stratotanker

7 KC-135R Stratotanker Tanker Aircraft, which provide the Turkish Air Force with the opportunity to become a global force and significantly increase the operational efficiency by giving the combat units the ability to respond to threats around our country without changing their locations, operate within the 101st Tanker Squadron (Call Name: Asena) stationed at the 10th Tanker Base Command in İncirlik, Adana. The planes were delivered to the US Air Force in 1959-1963 in the KC-135 configuration. They were decommissioned in 1993 and started to be stored at the 309th Aerospace Maintenance and Regeneration Group (AMARG), and later modernized and delivered to the Turkish Air Force between December 1997 and July 1998.

The TurAF first gained air refueling capability in July 1995 with the leased KC-135R Aircraft and later in December 1997 with the second-hand KC-135R Aircraft, taken out of storage from AMARG in 1996 and modernized with new engines and avionics. With a fuel capacity of 92 tons, the KC-135R can transfer 52 tons of fuel to other aircraft during air-to-air refueling. The KC-135R Stratotanker, which can stay in the air for 8 hours during aerial refueling missions, has a range of 2,419km (up to 17,766km for ferry missions). KC-135R Airplanes are equipped with an aerial refueling boom in the tail to refuel aircraft with embedded refueling ports/receptacles. However, a "boom-drogue adapter" can be attached to the boom for aerial refueling of aircraft with refueling probes (the tanker retains its articulated boom but has a special shuttlecock-shaped hose/drogue, sometimes called a basket, at the end of it instead of the standard nozzle). The 101st Tanker Squadron has a limited number of this refueling adapter in its inventory and is generally used during aerial refueling missions in multinational exercises.

Metal fatigue now occurs in the KC-135R Aircraft in the inventory of the 101st Tanker Squadron, the youngest of which is 58 years old, and the maintenance, repair, and operating costs of the aircraft are gradually increasing. KC-135R Aircraft were modernized with Global Air Traffic Management (GATM) System avionics in the early 2010s. In this context, the first upgraded KC-135R aircraft was delivered in April 2011. Additionally, the US Air Force provided training to Turkish Air Force personnel for the GATM System under a two-week course held at Mildenhall Air Base of the Royal Air Force in England. The course consisted of two phases, Classroom Training and On-board Training. KC-135R Aircraft had previously undergone Pacer-CRAG (Compass Radar and Global Positioning System) modernization

ATMACA Hits a Real Ship Target for the First Time

The ATMACA Anti-Ship Missile developed by Roketsan with the latest technological advancements recently hit a ship target for the first time in the final fire test before its entry into the inventory. ATMACA will strengthen modern navy platforms with its long range and high precision and it is planned to be delivered to the Naval Forces Command in the second half of 2021.

Launched from the TCG Kınalıada corvette, the Surface-to-Surface Anti-Ship Missile ATMACA hit its ship target on June 18 successfully, as in previous fire tests.

Minister of National Defense Hulusi Akar, Force Commanders, Head of the Digital Transformation Office Ali Taha Koç, Vice President of Defense Industries Faruk Yiğit, Roketsan General Manager Murat İkinci and foreign delegations watched the fire test live. Before its entry to the inventory, ATMACA managed to get full credit in the final firing test.

Tests Started in 2016

ATMACA's first flight test was carried out in 2016 and at that time successfully completed many shots during the test and qualification process. The serial production contract was signed on October 29, 2018, and the first firing test of ATMACA was carried out from the TCG Kınalıada corvette in November 2019. ATMACA also hit the target with full accuracy in the test carried out with live warhead configuration in February 2021.

ATMACA differentiates itself from its competitors

ATMACA can be utilized in all weather conditions and it is resistant to countermeasures with target update, re-attack and mission abort capabilities. In addition, thanks to the advanced mission planning system (3D routing), it can be effective against fixed and moving targets. Equipped with a Global Positioning System (GPS), an Inertial Measurement Unit, Barometric Altimeter and Radar Altimeter subsystems, ATMACA uses its active radar seeker to find its target with high accuracy.

With a range of over 220 km, ATMACA has an advanced and modern data link for its target update, re-attack and mission abort capabilities. The system offers the most efficient mission profile and provides operation modes of timing, firing and hitting the target.

ATMACA also makes a difference with its prominent structural design. In line with developing technologies, the missile was designed using composite material technologies to reduce weight and increase structural strength, and with maximum utilization of these technologies in the production of the missile. ATMACA was developed with domestic and national resources and will be used effectively by the Naval Forces for the protection Turkey's interests and rights in the Blue Homeland and will undertake important tasks in this field ■

ATMACA Anti-Ship Missile Technical Features
Length: 4.3 m – 5.2 m
Weight: < 750 kg
Range: > 220 km
Guidance: Inertial Navigation System + Global Positioning System + Barometric Altimeter + Radar Altimeter
Warhead Type: High Explosive with Penetration
Warhead Weight: 220 kg
Data Link: Target Update, Re-Attack, Re-Target and Mission Abort Capability
Seeker: Active RF

Turkish Defence & Aerospace Sector Has Managed to Increase Its Exports by 45.5% During First Six Months of 2021!

by İbrahim SÜNNETÇİ

Exporting its defence products to over 140 countries around the world Turkey is targeting to become a top six country in the world in terms of defence and aerospace exports. According to "Strategic Plan 2019-2023," document issued by the SSB on December 4, 2019, Turkish Defence and Aerospace Sector's annual turnover will rise to US$26.9 Billion, from US$8.761 Billion in 2018, defence and aerospace (both military and commercial) exports to US$10.2 Billion and the local content rate in defence and aerospace projects will reach to 75% by the end of 2023, the year that will mark the first centennial of the Republic of Turkey.

Having closed the year 2020 with an exports revenue of US$2.279 Billion (TIM figure, according to SASAD 2020 Performance Report the total of export revenue in 2020 was US$2.266 Billion), which represents a 16.8% decrease in export of defence and aerospace products compared to 2019, Turkish Defence and Aerospace Industry has managed to increase its exports with considerable figures during the first five months of 2021. As per the monthly export data announced by the Turkish Exporters Assembly (TIM), Turkish Defence and Aerospace Industry exports has increased 3.7% in January, 34.1% in February, 74.6% in March, 47.8% in April, 51.6% in May and 32.6% in June compared to the same period of the previous year, despite the negative effects of the COVID-19 pandemic. Export revenues are expected to increase further in 2021 and even exceed 2019 (US$2.740,144 Billion according to TIM data), which closed at record high.

According to Turkish Exporters Assembly (TIM) data, the Turkish Defence and Aerospace Industry realized US$$166.997 Million in defence and aerospace equipment exports in January, US$233.225 Million in February, US$$246.973 Million in March, US$302.516 Million in April, US$170.346 Million in May and US$221.791 Million in June. According to TIM's data, while the Turkish Defence and Aerospace Sector achieved some 29% increase in exports in June 2021 compared to the previous month, during January 1st – June 30th of 2021, the Turkish Defence & Aerospace Sector has managed to increase its exports by 45.5% to US$1.341.848 Billion level compared to the US$922.528 Million realised during the same period in 2020.

In parallel to steadily, even sharply, increase in export revenues, the total weight of products exported by the Turkish Defence & Aerospace Industry is also in upward trend. According to data released by the TIM, while the Industry has exported 3.627 tons of defence and aerospace equipment in June 2020, it increased to 5.654 tons in June 2021, represents a 55.9% increase. And during January 1st – June 30th of 2021 Turkish Defence & Aerospace Industry has managed to export around 32.828kg weight of defence and aerospace equipment, which represents around 70.5% increase compared to the same period of the previous year (19.256kg). So as of the end of June 2021, the average price of Turkish Defence & Aerospace export products during first six months of 2021 has reached to US$40.8 per kilogram.

Providing more efficient, low cost, combat proven, and less problematic NATO-standard high-tech products for arms buyers, Turkey emerges as a new arms exporter. Turkish Defence & Aerospace Industry has managed to put 7 firms (ASELSAN, TUSAŞ, BMC, ROKETSAN, STM, FNSS and HAVELSAN) on world's 100 largest defence companies in 2020. According to TIM figures the list of the top 15 countries that imported defence and aerospace products from Turkey during January 1st – June 30th of 2021 is composed of; the U.S.A., Azerbaijan, the UAE, Germany, Bangladesh, Tunisia, the UK, Uzbekistan, China, Jordan, Rwanda, Russian Federation, Qatar, Poland and the Netherlands.

As in previous periods, the U.S.A. ranked first in the defence and aerospace industry exports during January 1st – June 30th of 2021. Exports to this country increased by 67.8% to US$582.084 Million (mainly military and civil helicopter and aircraft parts, component sales realized under offset commitments and hand guns). With a total of around US$163.930 Million in purchases, Azerbaijan the second largest recipient/importer followed by the UAE with around US$109.775 Million (represents a merely 3% increase compared to 2020). Germany with US$79.360 Million ranked 4th in the list. Bangladesh ranked 5th withUS$57.480 Million (represents a 8.191,2% increase compared to 2020 and mainly stemming from ROKETSAN's delivery of 3 TRG-300 Tiger Guided Artillery Rocket Batteries with 18 Multi Barrel Rocket Launcher Systems (on KAMAZ 65224 tactical wheeled vehicle) as well as ASELSAN's radio sets and MILMAST's FHM-EM series telescopic mast which host wide band radio communication system antenna, Bangladesh is also said to have interest to purchase 12 HURKUS-Bs and T129Bs from TUSAS, HISAR-O+ Air Defence Missile System from ASELSAN/ROKETSAN and BAYRAKTAR TB2 UCAVs

from BAYKAR DEFENCE). Tunisia with US$31.057 Million (represents a 12.201,9% increase compared to 2020 and mainly stemming from a US$150 Million contract awarded during the second half of 2020 and covers the deliveries of 5 Turkish Defense & Aerospace Industry companies' products including TUSAS' ANKA-S UCAVs, NUROL MACHINERY's EJDER YALCIN 4x4 wheeled armoured vehicles and ASELSAN's electro-optic systems) ranked 6th in the list. These countries were followed by the UK with US$21.677 Million, Uzbekistan with US$21.096 Million, China with US$20.486 Million (represents a 76.577,6% increase compared to 2020), Jordan with US$19.313 Million (represents 5.148,7% increase), Rwanda with US$16.460 Million (represents around 13.603.206% increase compared to 2020 [just at US$12.000 Thousand level] and mainly stemming from Katmerciler's 4x4 HIZIR, ATES and KHAN wheeled armoured vehicles ordered under a Euro39.450 Million contract disclosed on February 1, 2021), Russian Federation with US$14.530 Million, Qatar with US$14.346 Million, Poland with US$13.411 Million and the Netherlands with US$11.817 Million (represents a fall by 59.5% compared to 2020).

According to TIM's data during January 1st – June 30th of 2021, the Turkish Defence & Aerospace Industry has exported US$594.965 Million (represents a 66.4% increase compared to 2020) in defence and aerospace equipment to North America/U.S.A., US$153.919 Million (represents a 10.5% decrease compared to 2020) to EU Member Countries, US$33.737 Million (represents a 23.2% increase compared to 2020) to other European countries, around US$158.718 Million (represents around a 12.5% decrease compared to 2020) to the Middle East countries, US$207.226 Million to the Commonwealth of Independent States (CIS, represents a 566% increase compared to 2020), around US$88.080 Million to other Asian countries, around US$71.051 Million (represents a 1.106,6% increase compared to 2020) to African countries and around US$13.437 Million (represents a 62.9% decrease compared to 2020) to countries in the East Asia ■

Turkey Exports Bayraktar TB2 UCAVs to Poland

Turkey`s first operational UCAV, Bayraktar TB2, designed and developed indigenously by Baykar Defense, will be exported to Poland. The export contract was signed at the Presidential Complex by Baykar General Manager Haluk BAYRAKTAR and Polish Defense Minister Mariusz BLASZCZAK in the presence of President Recep Tayyip ERDOĞAN and Polish President Andrzej Sebastian DUDA.

May 24, 2021, Bayraktar TB2 UCAVs will fly in the skies of Poland after Ukraine, Qatar, and Azerbaijan; thus, for the first time, Turkey will export a state-of-the-art UCAV (Unmanned Combat Aerial Vehicle) to a NATO and European Union (EU) member country.

Within the scope of the contract, Turkey will deliver 4 systems, including 24 Bayraktar TB2 UCAVs, ground control stations (GCS), and ground data terminals (GCT). In addition, MAM-C and MAM-L smart micro munitions developed nationally by Roketsan will be exported to Poland.

According to Baykar Defense, the Bayraktar TB2 UCAVs in the inventory of the Turkish Armed Forces and Security Forces accumulated 120,000 flight hours in 2020. Thus, TB2 UCAVs surpassed 320,000 hours of successful flight in total. This figure is above the total flight hours performed by manned military aircraft in Turkey. Currently, 180 Bayraktar TB2 UCAVs are in service with the Armed Forces of Turkey, Ukraine, Qatar, and Azerbaijan.

The contract signed in Ankara includes 4 systems (24 Bayraktar TB2 UCAVs) as well as ground control stations, ground data terminals, MAM-C & MAM-L smart micro munitions, SAR radars, simulators, spare parts, training, and logistics support services. In addition, according to the Polish Ministry of National Defense, the contract also includes a 24-month warranty period and technology transfer for the maintenance of engines, ground control stations, and electro-optical targeting systems. It is also stated that the first set of UCAVs will be delivered to the Polish Armed Forces by the end of 2022, and the entire order is expected to be completed by the end of 2024. The report also states that the cost of one set of TB2 systems is US$67 million, so the total sales price is estimated at around US$260-270 million.

3rd Gökbey Helicopter Prototype Successfully Performed Its First Flight

On June 28 President of Defense Industries Prof. Dr. İsmail DEMİR announced that the 3rd Gökbey Helicopter prototype successfully performed its first flight. Sharing a video of the test DEMİR said, "With this flight, which lasted approximately 40 minutes, we included a new prototype in flight test activities."

The T625 Multi-Role Helicopter Program was initiated to meet the light-weight class helicopter requirements both for military and private users worldwide. It was launched upon the decision of the Defence Industry Executive Committee dated on June 15, 2010. The Turkish Light Class Utility Helicopter (TLUH) Program was signed between the SSB and Turkish Aerospace which was awarded the amount of US$687.3 million in a contract dated June 26th, 2013. The contract became effective on september 6 and the kick-off meeting was held on October 11th, 2013.

4 Turkish Companies Compete in the Medium Class UGV Project

On June 27, President of Defense Industries Prof. Dr. İsmail Demir stated that they are determined to show their experience and success in unmanned aerial vehicles (UAV) in sea and land vehicles He shared the following via his social media account, "We are determined to show our experience and success in UAVs in sea and land vehicles as well. Within the framework of our Medium Class 1st Level Unmanned Ground Vehicle (UGV) Project, we continue our prototype racing activities. After the inspection and mobility tests of the UGVs produced by Aselsan, Best Grup, Elektroland, and Havelsan, firing tests were also carried out with the 7.62 mm weapon system. Following performance tests, we will complete our prototype race next month."

The U.S. Approves T129 ATAK Export to Philippines

In April 2021, TUSAŞ President & CEO Temel KOTİL made a statement on CNN Türk that the U.S. has given permission for the engines of the ATAK helicopters to be exported to the Philippines and that they will start the production of T129s in the coming months. KOTİL, on the other hand, stated that the United States has not yet approved for export to Pakistan.

Speaking at an event organized by Yıldız Technical University, TUSAŞ Corporate Marketing, and Communications President Serdar DEMİR stated that TUSAŞ had signed contracts with Pakistan and the Philippines for the export of T129 helicopters. "We are still waiting for Congress approval for Pakistan, and we are working for it. The approval process for the Philippines has been completed. For the first time, the ATAK helicopter will be exported abroad."

Pakistan and Turkey signed a US$1.5 billion contract for the sale of 30 T129 Attack and Tactical Reconnaissance Helicopters in 2018.

TEBER Guidance Kits to Receive Adjustable Proximity Sensor

On July 14, President of Defense Industries Prof. Dr. İsmail DEMİR shared a video on his social media account stating that the TEBER laser guidance kits used on the MK-82 General Purpose Bombs will be integrated with an adjustable Proximity Fuze, developed by Roketsan. DEMİR said, "The adjustable Proximity Sensor, developed by Roketsan, will be integrated into the TEBER laser guidance kits used on the MK-82 General Purpose Bombs. Thus, the effectiveness of our precision-guided munitions will be increased."

Roketsan Starts Serial Production of the New Armor Package for Leopard 2A4 Tanks

President of Defense Industries Prof. Dr. İsmail DEMİR announced that the Turkish Land Forces Leopard 2A4 tanks have started their upgrade to domestic armor packages designed and produced to meet modern operational requirements. President DEMİR made the following statements on his social media accounts regarding the armor package for Leopard 2A4 tanks.

As part of our effort to increase the capabilities of the Leopard 2A4 tanks in the Turkish Land Forces inventory, we started the serial production of the armor packages designed and produced at the Ballistic Protection Center in Roketsan. The armor package, which was developed in different configurations for turret and hull, will provide superior ballistic protection for Leopard 2A4 tanks and increase their survivability on the battlefield.

In a press release published by Roketsan in February 2021, it was stated that 2 Leopard 2A4T1 tanks were delivered to the Turkish Armed Forces in December 2020. Within the scope of the project, a total of 40 tanks are planned to be modernized.

PARS IV 6x6 Special Ops Variant to be Delivered This Year

The Presidency of Defense Industries announced on its official social media account that the PARS IV 6x6 Special Operations Vehicle will be delivered to the security forces this year. Developed as part of the PARS 6x6 Mine-Resistant Vehicle Project, PARS IV 6x6 Special Operations Vehicle offers the highest protection in its class. The vehicle provides protection against hand-made explosives, high mine & ballistic protection and advanced mission equipment.

The introductory meeting for the 6x6 Mine-Resistant Vehicle Project, in which FNSS is the main contractor, was held at the FNSS Gölbaşı facilities on July 19, 2020, with the participation of the President of Defense Industries Prof. Dr. İsmail DEMİR, the Ministry of National Defense, Turkish Armed Forces, General Directorate of Security and defense industry representatives. Initially, 12 vehicles will be delivered to the Turkish Armed Forces.

Next-Generation Electronic Warfare System SANCAK Delivered to Turkish Armed Forces

President of Defense Industries Prof. Dr. İsmail DEMİR announced on his social media account that the Next Generation Electronic Attack System SANCAK was delivered to the Turkish Armed Forces. DEMİR shared, “We have delivered the Next-Generation Electronic Attack System SANCAK to the Turkish Armed Forces, which will provide a significant advantage on the battlefield by neutralizing strategic communication systems."

Next Generation Jamming System SANCAK (MILKAR-4A2 HF EA System) provides new capabilities such as:

- High mobility
- Broadband high output power
- Jamming/deception in different types and modes
- Electronic Support with broadband receiver
- Automatic link building and demodulation.

AKSUNGUR will be the Backbone of Firefighting

Developed by Turkish Aerospace, the AKSUNGUR Unmanned Aerial Vehicle (UAV) System has started its first duty. Taking off from TUSAS Facilities in ANKARA, AKSUNGUR will be located ADANA Şakirpaşa Airport. It will be operated by the General Directorate of Forestry for firefighting purposes.

The AKSUNGUR UAV was developed by national and domestic capabilities and has broken the flight hours record. AKSUNGUR started to serve the General Directorate of Forestry for fire control and firefighting purposes. AKSUNGUR was developed in 18 months and has the capacity to perform uninterrupted multi-role intelligence, surveillance, reconnaissance and attack missions with its high payload capacity, and provides Beyond Line of Sight (BLOS) operation flexibility with a SATCOM payload.

TUSAŞ to Procure 14 Engines from Ukraine's Motor Sich for Heavy Class Attack Helicopter

Turkish Aerospace (TUSAŞ) and Ukraine's Motor Sich Company signed a contract to purchase 14 2,500hp turboshaft engines for ATAK 2 Heavy Class Attack Helicopter Project, also known as T929. According to the statement from TAI on June 29, the first flight of the 11-ton T929, which will have nearly twice the take-off weight of the current ATAK helicopters, is scheduled to be carried out in 2023. TUSAŞ continues its studies for the helicopter to be developed under the Heavy Class Attack Helicopter Project Contract signed with the Presidency of Defense Industries (SSB) in 2019.

According to the contract between TUSAŞ and Motor Sich, the first two engines will be delivered in September 2022, and the deliveries will be completed in 2025.

Commenting on the deal, TUSAŞ President and CEO Temel KOTİL said the company passed another important threshold and critical phase for the heavy class attack helicopter. "As we promised, we have completed another important and critical phase for our Heavy Class Attack helicopter, which will take off in 2023. Hopefully, as TUSAŞ, we will make an ambitious entry to 2023, in the 100th year of our Republic. Almost all our projects will make their maiden flights in 2023," KOTİL said.

Turkish Aerospace is Building Europe`s Second Biggest Wind Tunnel For the Turkish Fighter

Turkish Aerospace is building Turkey's biggest and Europe's second largest subsonic wind tunnel facility. The facility is underway for the purpose of carrying out wind tunnel tests of Turkish Fighter. The wind tunnel is intended to be used in the development of indigenous, rotary-wing and fixed-wing aircraft, especially the Turkish Fighter.

The tunnel will have three different test sections, large, small and open. The test specimens will be positioned in these sections and will be equipped with state-of-the-art technology measurement and sensing devices for advanced testing.

With the integrated moving ground belt system, landing and take-off tests for aircraft will be carried out only in this tunnel in Turkey. In addition to these test capabilities, the production, integration and instrumentation of the models to be tested will also be carried out in this facility and significant contributions will be made to the product development process.

Turkish Aerospace President & CEO Prof. Temel KOTİL said, “We are building the second largest subsonic wind tunnel facility in Europe. We keep working in order to achieve our biggest project Turkish Fighter. Our facility will be the only facility in Turkey in this field with the capability to allow aeroacoustics testing.”

HENSOLDT and Nano Dimension Establish Joint Venture for 3D Printing Platform

Sensor solutions provider HENSOLDT is strengthening its commitment to the future technology of 3D printing: together with 3D printer manufacturer Nano Dimension, HENSOLDT is founding a joint venture under the name J.A.M.E.S (Jetted Additively Manufactured Electronics Sources), based in Taufkirchen/Germany, which will combine the strengths of both companies and further advance the development of 3D-printed electronic components.

The joint venture is led by HENSOLDT Ventures, an independent division within HENSOLDT that implements new technologies and business models for the HENSOLDT Group and brings them to market. Most recently, HENSOLDT expanded its Ventures portfolio earlier this year with the acquisition of data analytics company SAIL LABS.

HENSOLDT, as a market leader in the field of sensor technology and optronics, expects closer cooperation with Nano Dimension to accelerate development cycles as well as spare parts production to be able to respond to customer needs more quickly and cost-effectively. With the help of special dielectric and conductive nanoparticle inks, it is possible to design electrical components directly via the printer and bring them into a three-dimensional form.

Nano Dimension is a leading manufacturer of intelligent machines to produce Additively Manufactured Electronics, or AME, and is already producing the first 3D-printed electronics in its multi-Jet process. AME is a very agile and customized method for developing electronic circuits. This leads to a significant reduction of time and costs in the development process. In addition, AME delivers a verified design before production begins, resulting in a higher quality of the final product.

The newly formed 3D printing joint venture focuses on building a cloud-based platform. In the future, other companies and customers will be able to upload a wide variety of electronic components in their usual CAD software and convert them into a new type of AME file on the platform. They will also be able to obtain further designs via the platform described, modify them, add their own form factor and have them printed on-demand.

HENSOLDT has been investing in basic research into digital 3D printing of electronic components for several years to make the advantages of this technology available for its own development and production. For example, in collaboration with Nano Dimension, HENSOLDT has already printed the world's first 10-layer printed circuit board (PCB), which carries soldered high-performance electronic structures on both outer sides, using a specially developed polymer ink from Nano Dimension.

Slovak Vipers to Fly with Rohde & Schwarz Radiocommunications

Thanks to the collaboration between Rohde & Schwarz and Lockheed Martin, the Slovak Air Force has become the next customer to receive F-16 aircraft equipped with Rohde & Schwarz secure communications. The Slovak Air Force will receive 14 F-16 Block 70 Viper aircraft in the mid-2020s. To increase local support and service capabilities for the air force, Slovakia will also procure an R&S URTS universal radio test set.

Rohde & Schwarz will provide the AN/ARC-238 software-defined radio (SDR), the U.S. government designation for the independent company's R&S MR6000R/L radios.

The AN/ARC-238 system consists of two transceivers: a remote-controlled transceiver installed in the avionic bay and a transceiver in the cockpit accessible by a local control panel. Both cover the frequency range from 30 MHz to 400 MHz and support the NATO frequency hopping algorithms (TRANSEC) HAVE QUICK II and SATURN.

Rohde & Schwarz is the preferred supplier of airborne radiocommunications for new production F-16 Block 70 aircraft. The Viper is the latest and most advanced F-16 production configuration.

MBDA's CAMM to Strengthen Air Defence Capability of Royal Navy Type 45 Destroyers

MBDA has been awarded a number of new contracts to significantly upgrade the air and missile defence capabilities of the Royal Navy's six Type 45 destroyers.

The work will see CAMM (Common Anti-air Modular Missile) paired with an upgraded Sea Viper command and control (C2) system for the first time. CAMM offers both world-leading close-in and local-area air defence and will complement Aster 30, strengthening the anti-air defence capability of the Royal Navy.

Fitting CAMM onto the Type 45s will give the destroyers a 50% increase in the number of its air defence missiles. The installation will be via 24 additional launcher cells, and the Sea Viper C2 will get a technology upgrade, giving it a major increase in processing power.

The existing 48 Sylver cells on the Type 45 will now be solely for the longer-range Aster 30 missile, which is also subject to a recently announced mid-life refresh. This will see the missile remain in service throughout the life of the Type 45s.

CAMM has already been delivered to both the British Army and the Royal Navy, where it is the interceptor in both ground-based air defence (GBAD) and naval-based air defense (NBAD) systems, enabling these services to equip missiles from a shared stockpile.

In service on upgraded Royal Navy Type 23 frigates, CAMM will also be fitted to Type 26 and Type 31 in the future. The CAMM family has proven a rapid success with international customers, with Canada and Brazil among the new users ordering the missile this year.

Milrem Robotics and Innovfoam Present the Multiscope Rescue Hydra UGV at Sofins

The leading European robotics and autonomous systems developer and system integrator Milrem Robotics and InnoVfoam, the specialist in foam extinguishing technology, present the Multiscope Rescue Hydra unmanned ground vehicle (UGV) at the Sofins exhibition held in France from June 29 until July 1. The jointly developed firefighting solution combines Milrem Robotics' unmanned ground vehicle (UGV) Multiscope Rescue and InnoVfoam's Hydra fire monitor and foam proportioning system.

The firefighting robot can be remotely operated by firefighters who remain at a safe distance while receiving a complete overview of the operation area via various thermal and infrared cameras and sensors onboard the robot that can additionally detect gas or chemical leaks. The fire monitors can be operated independently from the UGV thanks to separate cameras on the UGV and the monitors allowing the vehicle to change position while maintaining a perfect overview of the fire. The system can also be complemented with additional preventive and repressive systems and autonomous functions.

The Multiscope Rescue has a maximum payload capacity of 1200 kg and pull force of 15,000 N, allowing it to be equipped with a variety of specific firefighting payloads, including foam or water tanks, but also tethered drones for better situational awareness. Robot firefighters can also deliver heavy firehoses to reach areas and enter inaccessible structures with bigger vehicles or may collapse on top of firefighters. They also help firefighters conserve energy and time. In forest or landscape fires, the robot firefighters can be airdropped to start limiting the spread of fires. InnoVfoam's fire monitors can dispense water and foam from 2000 up to 20,000 liters per minute.

Billion-Euro Contract for Rheinmetall – Bundeswehr Upgrading Puma Infantry Fighting Vehicle to New Design Status


© Rheinmetall

Rheinmetall has won a major order from the German Bundeswehr in the armoured vehicle domain, representing a sales volume of well over half a billion euros. Issued through the joint venture company PSM GmbH, the contract encompasses upgrading the first lot of the Bundeswehr's Puma infantry fighting vehicle, bringing them up to a uniform enhanced design status. PSM GmbH is co-owned by Rheinmetall and Krauss-Maffei Wegmann, each holding a 50 percent share in the company.

The contract for modernizing Germany's fleet of Puma IFVs was signed on 28 June 2021 at the Federal Office for Bundeswehr Equipment, Information Technology, and In-Service Support (BAAINBw) in Koblenz. Work is slated to begin immediately in July 2021 and is expected to be complete in 2029. Now official, the initial phase of the order encompasses 154 vehicles, generating sales for the consortium of €1.04 billion. Rheinmetall's share here comes to €501 million (with value-added tax), which will be booked as an incoming order at the start of the third quarter of 2021. For Rheinmetall, anticipated consortium-internal subcontracting, e.g., in the electronic vision systems domain, is expected to mean additional orders in the three-digit million-euro range.

The contract also contains an option for modernization of a further 143 Puma infantry fighting vehicles, which for the PSM consortium would mean additional sales volume totaling €820 million, once again including VAT. Well over half this amount would be allotted to Rheinmetall. The major refit now being embarked on is intended to bring the majority of the first lot of the Bundeswehr's existing fleet of 350 Puma vehicles up to S1 enhanced design status. In preparation for the NATO High Readiness Joint Task Force VJTF 2023, which will be furnished by the Bundeswehr, forty Puma IFVs have already been upgraded to S1 status. Of Germany's 350 Pumas, the only ones not included in the modernization program are the 13 driver training vehicles.

Among other things, the new S1 version of the Puma is characterized by standoffcapable effectors like the MELLS multirole lightweight guided missile system, additional sensors such as the new driver's vision system, and improved command-and-control architecture. The parabolic and driver vision system heralds the end of the periscope era. For the first time, the entire crew will be able to "see-through" the armor, day and night. The fusion mode combines daylight vision with a high-quality thermal image, enabling early detection of camouflage targets around the clock. The S1 version of the Puma version is the first western combat vehicle that includes a system of this type as a standard feature.


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Rheinmetall Spectac – An Innovative Stun Grenade for Military and Law Enforcement Special Operators

Rheinmetall presents Spectac, its innovative new non-lethal effector. This rectangular stun grenade is specially designed for use by military and law enforcement special operators. The most striking feature of the easy-to-use Spectac is its smartphone-like design, with the locking ring and rocker arm ignitor built into a rectangular housing the size of a mobile phone.

Its novel design offers several advantages. Weighing approximately 350 grams, 110 mm long, 63 mm wide, and 20 mm thick, this highly ergonomic one-bang stun grenade slips easily into the tactical kit of the special operator, making it very convenient to carry. In addition, its compact design means that it can be discretely taken along on undercover and bodyguard operations. Moreover, its rectangular shape offers other tactical benefits. Unlike traditional round grenades, the Spectac does not roll away in an uncontrolled way after landing but instead comes quickly to a halt, making it ideal for use on stairways. Its maximum movement radius comes to just 35 cm at most. As a result, the desired effect reliably takes place in the intended target zone.

Waterproof at depths of up to 20 meters, the Spectac produces a blinding flash and deafening bang. It is currently available in versions with acoustic pressure levels of 170 and 180 decibels and two delay times, 0.5 and 1.5 seconds. To make it even safer to handle, Rheinmetall engineers opted for a tried-and-tested bottom-top venting (BTV) design. This way, in the event of an inadvertent detonation, the explosive effect blows out of the top and the bottom of the grenade, reliably protecting the user's throwing hand. The Spectac does not produce dangerous fragments. Each Spectac grenade is X-rayed prior to shipment, thus assuring maximum functional reliability and safety. The X-ray images are stored for ten years. Neither the percussion cap nor the ignition delay mechanism contains lead compounds. In addition, the grenades are compliant with REACH, the European Chemicals Directive.

Successfully qualified at the end of 2020, the Spectac is available effective immediately. This innovative product confirms Rheinmetall's role as a leading supplier of pyrotechnic effectors for law enforcement and military applications.

History Made as WFEL Commences Production of First Boxer Armored Military Vehicles

In another historic event for the UK Defence industry, WFEL has commenced production of Boxer Mechanized Infantry Vehicles for the British Army at its new manufacturing plant in the North West of England. It has been many years since any new armored vehicles have been manufactured in the UK.

The fabrication of vehicle sub-assemblies has been taking place over the last few weeks at WFEL's new production facility at Stockport. As part of the extensive Technology Transfer Program between KMW and WFEL, UK welding personnel have undertaken secondments of up to a year at parent company KMW's Boxer manufacturing site in Hamburg, Germany. Here, staff worked on the production of Boxer vehicles for KMW's existing customers and are now fully qualified to undertake the complex work required to produce fabricated Drive Module hulls for the UK Boxer variants. WFEL has been selected as the KMW UK footprint for the Boxer MIV Program and will employ high levels of UK content, creating and protecting sovereign engineering and manufacturing skills, ensuring that the vehicles remain supported through their operational life.

As well as manufacturing the armored hulls for the British Army's new vehicles, WFEL will be responsible for the Assembly, Integration, and Testing (AIT) of a total of 225 Boxer MIV vehicles under the £2.3 bn contract signed between UK MoD and ARTEC in November 2019.

In November 2019, ARTEC, a joint venture between two German companies, Krauss-Maffei Wegmann and Rheinmetall, signed the £2.3bn contract to deliver 500+ Boxer vehicles to the British Army. The vehicles will be manufactured in the UK, with production subcontracted equally between WFEL and Rheinmetall BAE Systems Land (RBSL). The companies will undertake the fabrication of the armored vehicle structures together with the assembly, integration, and test of the complete vehicles at their respective facilities in Stockport and Telford.

INTERNATIONAL FUTURE SOLDIER CONFERENCE

19 OCTOBER 2021
Sheraton-Ankara

Within the scope of the planned conference program, panels, presentations, and discussions will be held in the following related technology fields:

- Combat Clothing, Individual Equipment & Balistic Protection
- Weapons, Sensors, Non Lethal Weapons, Ammunition
- Power Solutions
- Soft Target Protection
- Soldier Physical, Mental and Cognitive Performance
- Robotics and Autonomous Systems
- Medical
- C4ISTAR Systems
- Exoskeleton Technology
- CBRN
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