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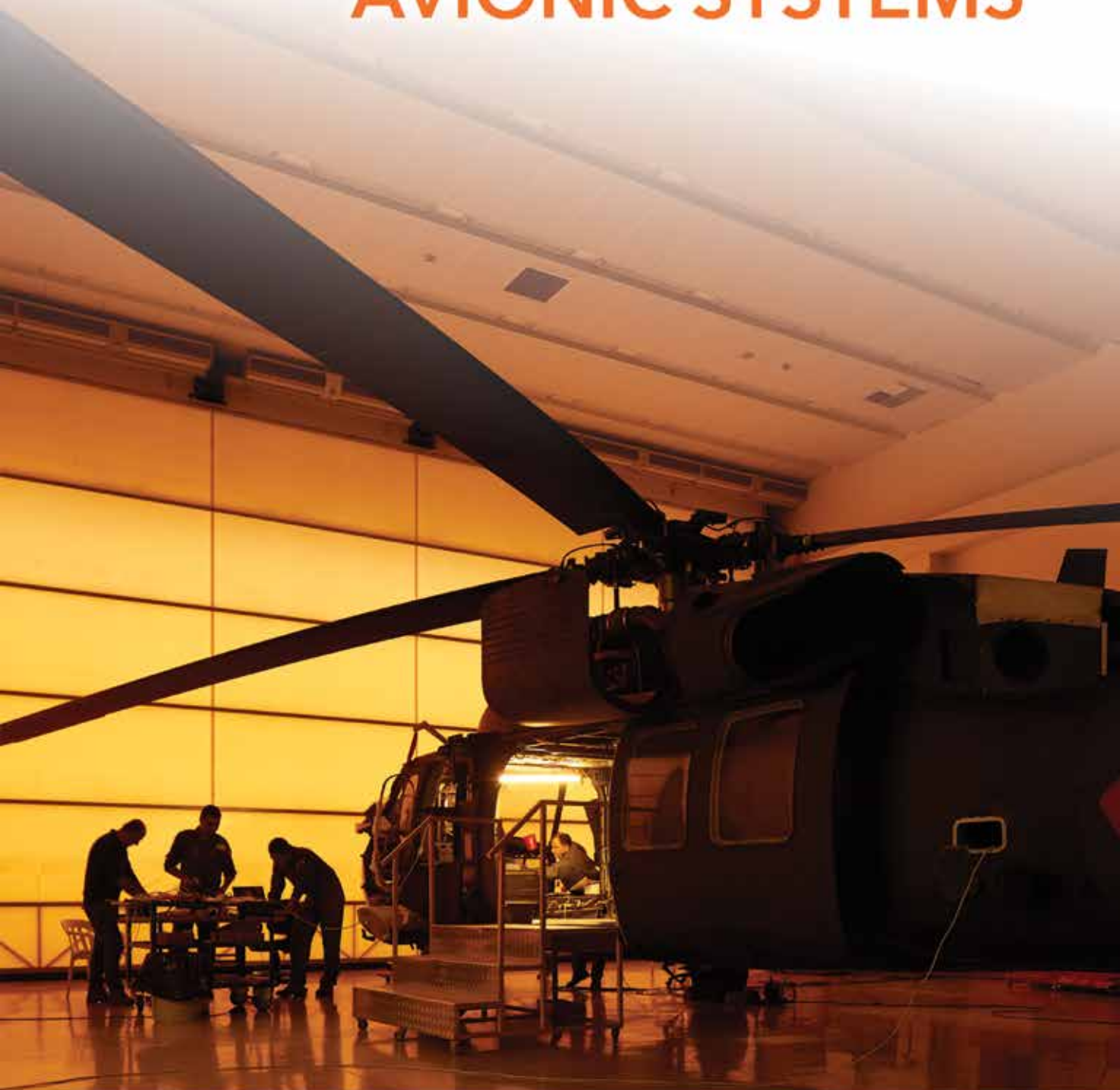
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East meets West: Eurasia Air Show 2018 Gathers Aerospace and Aviation Professionals in Antalya

Ayşe Evers
Publisher & Editor in Chief



The general aviation market with annual sales of just over \$25 billion stands at a distant third within the global aviation market. Due to huge supply constraints in scheduled air transport and falling defense expenditures by industrialized countries, it is expected that the global aviation market will grow at a CAGR of more than 3.5% by 2023. In light of this estimation, global market activities are becoming more important than ever.

With a reference of being a bridge between the Eastern and Western Aviation & Aerospace markets, The Eurasia Airshow will take place for the first time on 25-29 April 2018 in Antalya, gathering 300 aerospace giants from Turkey and 40 Nations, aerospace and aviation professionals with multinational aerobatic airshows and 80 aircraft displayed in the static area.

Under the auspices of the Presidency of the Republic of Turkey, the Eurasia Airshow has been accomplished with the support of the Ministry of National Defense, the Turkish Armed Forces, Ministry of Interior, Ministry of Transport, Maritime Affairs and Communications, Ministry of Economy, Ministry of Culture and Tourism, Ministry of Forestry and Water Affairs, Undersecretariat for Defense Industries, Undersecretariat of Ministry of National Defense, General Directorate of State Airports Operations, General Directorate of Civil Aviation, and other institutions.

For the first time, with the partnership of Turkish Airlines, the “Airlines CEO Summit” gathers the decision makers of commercial airlines. A conference on “Women in Air & Space Symposium” in which female pilots, entrepreneurs and academicians will participate will also be included in the organization for the first time as well. A platform composed of women with roles in aviation and space from all around the world is will be held through this conference that will last throughout the day.

Enjoy this issue... ■

Distinguished Eurasia Airshow Visitors,

The Aviation Sector has a restless and fragile structure under the global conditions and in the ongoing crisis of the system. Nevertheless, we see that it always succeeds to protect its dynamism. Cross-border conflicts and competitions have enabled the discovery of geographies offering new opportunities in the aviation sector.

In this context, Turkey has a strategic position in terms of geopolitics. In the aviation sector as well as in every trade field, it also serves as a bridge between the west and the east.

Within the last 13 years, while the growth rate in the aviation sector was 5% throughout the world, it was 15% in Turkey and it has not yet reached the saturation point. The fact that approximately 35,000 planes across the globe, in the next 20 years, will be released to the market from the production line and the 4.4% average annual growth in air traffic are clear indicators of how attractive the industry is.

“Eurasia Airshow brings together the giants of the Western and Eastern aviation industry”

Today, we have added one more show to the aviation shows taking place in the world's first league by evaluating all the developments in the aviation sector in Turkey and the region as well as those with high potential. We have had many difficulties on this challenging journey with the goal of being one of the strongest actors in the global aviation sector. But we are determined, confident and we are even more ambitious.

We are executing the Eurasia Airshow in the beautiful city Antalya under the auspices of President Mr. Recep Tayyip Erdoğan. By examining the stakeholder models at Airshows that have proven themselves and succeeded, we have tried to organize a stronger one. I am grateful for the valuable contributions of state institutions and authorities for every breathtaking moment we live here today. I am grateful to all institutions and organizations for providing full support, including the Ministry of Foreign Affairs, Ministry of Interior Affairs, Ministry of Economy, Ministry of National Defense and Undersecretariat for Defense Industries, Ministry of Culture and Tourism, Ministry of Transport and affiliated DHMI, SHGM, Chief of General Staff and affiliated forces.

“We are breaking new ground in Turkey”

The Eurasia Airshow is breaking new ground in Turkey in various aspects. In partnership with Turkish Airlines, together with the Airlines CEO Summit, we



are organizing an elite summit to evaluate current issues in the world civil aviation sector and to add value through experiences and perspectives.

Through the Women in Air & Space Symposium, we bring together the experienced, successful, entrepreneurial pilots and academicians of the aviation industry.

At the first Eurasia Airshow we are raising the flags of nearly 40 countries representing delegations and participants. We are taking off with nearly 300 distinguished participant companies and 80 aircraft to be exhibited as well as multinational acrobatic flight shows.

With the Eurasia Airshow, we promote the business generated by the country in aviation and business models, and at the same time, we are realizing a qualified business development platform where all parties will meet and discuss business, get to know each other and their abilities and make business connections.

We are honored to host you at the Eurasia Airshow, the meeting point of the great players of the West and the East in the aviation sector.

After a long and challenging journey that has lasted approximately 2 years, we are proud to witness this summit with you today.

I wish everyone a fruitful and beneficial fair in every sense.

Ferhat Yenibertiz
CEO of Eurasia Airshow

Everything Starts with a Dream...

This simple sentence is the firer of our lives that we are not aware of. What caused Hazarfen fly from Galata Tower was a dream, the start of Nu.D-36, which is the first single-engine plane that Nuri Demirağ produced 82 years ago, was also a dream.

Our dream is adding a “first” and “most” to this historical accumulation, technical information, perspective and dynamic. Eurasia Airshow was completely born from this vision: Organizing the first and biggest international aviation exhibition of our country based on air shows.

Turkey is one of the most important countries of the global aviation industry. More than 500 flights from Turkey are made to more than 300 destinations in the world with the continuously growing fleets of civil aviation companies and particularly with the fleets of our main partner Turkish Airlines. From another perspective, Turkey has the characteristics of an important meeting and center point for each field of civil, commercial or military aviation with its approximately 4-hour flight distances to the 60% of the world economy. The name of the project “Eurasia” is based on meeting and uniting.

In the military aviation, important industry giants such as Aselsan, STM, TAI and Alp Havaçılık and more than 2000 local industrialists serving to these companies exhibit the power of Turkish Aviation Industry.

We bring this power together with the global ecosystem in the most important tourism center of our country Antalya, as a strategic alternative to the most important aviation organizations of the world that are held in Dubai, Singapore, Paris, Farnborough, Berlin and Moscow.

An area of 200.000 square meters in total was built in the Antalya International Airport for the Eurasia Airshow, 35.000 square meters of which is a closed fairground. And this year, Eurasia Airshow hosts almost 300 exhibitors and military delegations from 60 countries in its first edition that is being held with your valuable participations. Number of air vehicles that will be exhibited and make demonstrations are 80. In this sense, I would like to thank you for sharing our dream. Your support has honored us.

We are in an endeavor to make the best for our country and it is a great honor to be supported by the top-level authorities of our country. We express our gratitude to the President of the Republic of Turkey H.E. Recep Tayyip Erdoğan for their high auspices. For all the support they provided from the beginning of the process till the day we held the organization, I would like to thank to our Minister Mr. Mevlüt Çavuşoğlu in the name of T.R. Ministry of Foreign Affairs, to our Minister Mr. Süleyman Soylu in the name of T.R. Ministry of Interior, to our Minister Mr. Ahmet Arslan in the name of the T.R. Ministry of Transport, Maritime Affairs and



Communications, to our Minister Mr. Nihat Zeybekçi in the name of T.R. Ministry of Economy, to our Minister Prof. Dr. Veysel Eroğlu in the name of T.R. Ministry of Forestry and Water Affairs, to our Minister Prof. Dr. Numan Kurtulmuş in the name of T.R. Ministry of Culture and Tourism, to our Minister Dr. Ahmet Demircan in the name of T.R. Ministry of Health, to the Commander of Turkish Armed Forces General Hulusi Akar in the name of Turkish Armed Forces, to the Undersecretary for National Defense Prof. Dr. İsmail Demir, in the name of T.R. Undersecretariat for Defense Industries, to the Governor of Antalya Mr. Münir Karaloğlu in the name of Antalya Governorate, to the Mayor of Antalya Metropolitan Municipality Mr. Menderes Mehmet Tevfik Türel in the name of Antalya Metropolitan Municipality, to the Head of Board Directors and General Manager of State Airports Authority Ms Funda Ocak in the name of General Directorate of State Airports, to the Director General of Civil Aviation Mr. Bahri Kesici in the name of General Directorate of Civil Aviation, to the distinguished team of Antalya Airport and to all institutions, organizations and companies, and to our Main Partner Turkish Airlines, our Platinum Sponsor Aselsan, our Golden Sponsors STM and ICF Airports, our Silver Sponsors Alp Aviation and Alp Technical Aviation.

We wish that all the current cooperation and works increasingly continue in the endeavor to make the best for Turkey. Looking forward to meet you at the 2nd Eurasia Airshow in 2020...

Hakan Kurt
Medyacity Chairman of Board



Turkey's Aviation Prominence – the Next Global Aviation Hub

In an exclusive Interview, the Director General of the Directorate General of Civil Aviation, Mr. Bahri Kesici discusses Turkey's industrial growth and success in the implementation of international standards and service quality. With accelerated growth in civil aviation expected in the years ahead, Turkey will become one of the top 10 markets in the world's domestic flight passenger numbers within the next twenty years

Defence Turkey: Dear Mr. Kesici, first of all we would like to thank you for your time. Could you briefly inform our readers on the Directorate General of Civil Aviation's main areas of activity, its duties and responsibilities?

With the amendment made on the law in 2005, our Directorate General was transformed into a special budgeted administration and it has been conducting its activities connected with the Ministry of Transport, Maritime Affairs and Communication as a governmental authority entitled to regulate and supervise the civil aviation industry as well as applying sanctions. Identifying the rules containing the international requirements that should be abided by the airline operators, launching the legislation and legal regulations and supervising the alignment of the operators' activities with these rules and regulations are considered amongst the main responsibilities of our Directorate General.

The authorization and licensing of all operators in the Civil Aviation industry, registration of air vehicles, accreditation of associations, supervision of air vehicles in respect to safety and airworthiness, certification of air vehicles and parts are being conducted by our Directorate General. All the operators within the scope of the industry, the airlines, air taxis, ground service associations, airporter operators, cargo agencies, maintenance organizations, training associations being in the first place, are subject to the legislation and supervision of our Directorate General.

Moreover, all the processes linked with the civil aviation industry; the execution of bilateral agreements with the authorization of domestic and international flights and our country's membership in the international civil aviation organizations fall under the scope of our responsibilities. As a governmental authority determining the rules of the aviation industry, their implementation and supervision, our main goal is to enable the alignment of the aviation activities in our country with the flight safety and aviation safety

requirements within the framework of the standards stipulated by the international organizations of which we are a member.

Defence Turkey: How do you assess Turkish Civil Aviation on global scale considering its pros and cons? What are your views and comments?

As known, within the scope of the Regional Aviation Policy launched in 2003, civil aviation activities became open to the private sector and great progress was achieved with the help of the resulting competitive environment. Since that date, our civil aviation has been growing each year with two-digit figures. Today our country has become one of the countries that contributes the most to the growth rates of both the European and overall worldwide aviation industry in respect to the increase in passenger and aircraft traffic.

We are among the top of the list not only considering industrial growth but also in respect to the implementation of international standards and service quality. During the supervision conducted by international associations, in addition to our success in the implementation rate of the alignment with global aviation standards, our country is one of the European countries with the lowest rate of findings during the air vehicle safety inspections. With our quantitative and qualitative achievements in aviation, we are considered to be a model for other countries and we have been organizing training in accordance with the protocol signed with the ICAO as part of our process conveying our experience in this area to the countries in our region.

With our memberships in the international organizations and our assignments in the decision-making mechanisms, especially our ICAO General Council Membership, Turkey is becoming a country that is regarded with admiration by the world on global scale and at the same time our country's prestige has been increasing each day within the scope of the global aviation system.

Without a doubt, there are still certain points that need to be improved and we have been working on them as the aviation industry is a global industry that involves competition with others while at the same time competing with oneself. Therefore, it is compulsory to proceed on the path with proper strategies that are in accordance with this boundless character of the civil aviation.

Defence Turkey: Regarding airline passenger and cargo transportation, it seems that the number of aircraft in Turkey increased over 200% within the last fifteen years and went over 500 while the number of passengers and cargo capacities have been constantly increasing concurrently. What is your vision for 2018 following the brief stagnation we went through in 2016 and upon the launch of the New Istanbul Airport?

Civil aviation in our country has entered a specific period as a result of the policies that have been implemented since 2003. The vision of our President Mr. Recep Tayyip Erdoğan, and under the leadership of our Prime Minister Mr. Binali Yıldırım and the management of our Minister Mr. Ahmet Arslan, our industry has achieved a constant two-digit growth rate. Without hesitation, the deregulation and marketization attempt of our government with policy in accordance with the motto of the "People's Airlines" paved the way of the growth in our industry, the number of aircraft in our airlines increased by 215 percent, the seat capacity increased by 249 percent, cargo capacity increased by 517 percent and the number of domestic and international flight points reached 360. The passenger and aircraft traffic data of the first quarter of 2018 indicate that we are the second country contributing most to European air traffic. Our airports are increasing the number of passengers mostly in Europe in January maintained the same success in February and reached the peak of European aviation. These developments indicate that the year 2018 will bring a new momentum to the growth of our civil aviation.

Our New Istanbul Airport will be launched into service on 29 October 2018. The capacity problems endured at Atatürk Airport will be bypassed henceforth and we rely on the fact that this development will accelerate the growth of our civil aviation in the years ahead. The projections of international aviation associations are also steering in this direction. It is noted that our country will become one of the top 10 markets in respect to the world's domestic flight passenger numbers within the next twenty years. It is foreseen that our country will enter the world's top five countries considering the growth rate. Therefore, 2018 will be a turning point for our civil aviation with the launch of the new airport and we will take the first and most critical step towards achieving our target of becoming a global hub in aviation.

Defence Turkey: As you also mentioned, the launch of the first phase of the Istanbul New Airport in the 3rd quarter of 2018 (29 October 2018) is expected. Could you please share the latest status of the activities that have occurred under your responsibility in this regard?

All activities regarding civil aviation composed of the authorization and licensing of operators, certification of the airport, aviation safety and cargo operations throughout the moving process are being conducted under the coordination of the relevant institutions and associations. In addition to the "Readiness for Service and Airport Transfer" (ORAT) meetings, the preparations are in progress and are being executed by different working groups under separate titles regarding authorization, licensing, safety and security issues. While the legislation and required legal regulations are being launched, the training sessions are being conducted by the airport operator for the new airport for the aviation staff.



New Istanbul Airport

Our Aerodromes Department has been uninterruptedly continuing their examinations regarding the alignment to international aviation standards. We held a workshop on Cargo and Postal Formalities in the beginning of April and within this scope, we evaluated logistical issues and certain points regarding the new airport. We have been conducting a far-reaching study ranging from the launch of the Istanbul New Airport to the status of the warehouses at the Atatürk Airport. In addition to the activities executed under the auspices of our Ministry, we have been conducting our activities by taking into consideration all the demands, especially of our industry in this area, with all relevant institutions and organizations, the National Police and the Ministry of Customs and Trade in particular.

Defence Turkey: Mr. Kesici, it seems that upon the 36 civil aviation negotiations that you conducted in 2017, the number of countries that Turkey made air transportation agreements with increased to

169. Which new countries and new frequencies will be added to these agreements in 2018? Could you please inform us on this issue?

Similar to our government's vision, that reads "Each Turkish Citizen will board a plane at least once in his lifetime" and in line with our Ministry's objective of "We will fly to all destinations around the world", we made bilateral aviation agreements a top priority of our aviation policy. In accordance with these goals, the number of bilateral aviation negotiations we made in the last fifteen years exceeded 500, adding new flight points to our flight network and achieving an increase in the number of flights. These agreements brought us the worldwide records we achieved in respect to the number of passengers and aircraft. Our international flight network reached over 300 points in 122 countries.

We accomplished negotiations with 36 countries last year and we will continue these negotiations at full steam this year as well. As of April 2018, civil aviation negotiations with Iran (30



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frequencies, 3 points), Democratic Republic of Congo (28 frequencies, 6 flight points), Uzbekistan (10 frequencies, 3 flight points) and Ukraine (420 frequencies, 4 flight points) have been executed and a total of 488 frequencies and 16 flight points have been added to the existing agreements signed with the aforementioned countries. Our activities to finalize the Air Transportation Agreement (HUA) with all member countries of ICAO (192 members including Turkey) have been continuing within the scope of our goals and we aim to increase the number of countries that we have agreements with to 172 by signing contracts with three more countries in 2018. Our attempts to execute negotiations continue with countries for which the existing regulations fail to fulfil demands (especially China, India, Russia and all Central Asian countries).

Moreover, we are willing to conduct negotiations with over 35 countries that have confirmed participation in the Turkey – Asia Civil Aviation Conference which will be held on 23 - 24 April 2018 in Antalya, hosted by our country, to review our existing relations. Finally, by attending the ICAN Conference organized every December by ICAO gathering the member countries and other participating countries to hold bilateral aviation negotiations, we plan to accomplish negotiations that are critical for our airlines.

Defence Turkey: You mentioned that you have officially invited civil aviation authorities of 192 countries to Turkey. How many countries are you planning to negotiate with, could you please inform us briefly on the activities conducted for this event, the content of the organization and your expectations from this conference?

We will be carrying out negotiations with over 35 countries which have confirmed their participation in the Turkey - Asia Civil Aviation Conference to develop our existing relations. Additionally, the other participating countries will be able to negotiate



with each other. Many esteemed figures leading today's civil aviation, especially ICAO Council President Olumuyiwa Benard ALIU will be attending the event. This conference will be a crucial platform for building regional and global cooperation and partnerships in aviation between Asian countries.

According to the 20-year projection of IATA, China, USA, India, Indonesia and Turkey are projected to be the markets with most rapidly increase in the number of passengers. The growth projected for the Asia-Pacific region and Turkey's existence in the world's fastest growing five markets are of vital essence in respect to this conference. This conference is regarded as a strategic step towards the cooperation of Asian countries in the global aviation market and it offers a great opportunity for the

realization of the projections that I mentioned previously. In addition, through support of the Eurasia Airshow which will be held during the same week, our objective is to contribute to tourism and the promotion of our country's aviation potential.

We will conduct a critical panel at an international level in which experts will participate as panelists who will discuss the latest developments in the world, challenges and deficiencies within the industry.

Defence Turkey: As the only institution authorized in airworthiness and certification of the Fixed and Rotary Wing Platforms manufactured indigenously in Turkey, what are your responsibilities and duties in this area?

Authorized by Law No. 2920 and Law No. 5431, our Directorate General identifies the airworthiness





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and noise standards allowing the utilization of the airframe, engine and propeller and other hardware of the air vehicles manufactured in our country in civil air vehicles. Authorization of operators running the design, production, maintenance, repair, overhaul and retrofit services in line with the identified standards and their inspection are amongst the responsibilities of our Directorate General. Our other activities such as the preparation of relevant documents, their approval, renewal of authorization and their cancellation when required and tracking of registries are being executed within this scope as well.

Defence Turkey: The type certificate for the first Turkish Trainer Aircraft "Hürkuş-A" manufactured in Turkey and certified in the international arena was granted to TAI in 2016. Could you please inform us on the latest status of the activities conducted as part of TAI- T625 Multi-Role Helicopter Project under development process, Aselsan's avionic device certification and İTÜ – TAI Ultra-Light Aircraft design project's certification?

Within the scope of the T625 Multi-Role Helicopter designed by TAI, and in accordance with the CS-29 Certification Specification and ICAO Annex 16 requirements, activities for the discussion formed based on the air vehicle sub-systems continue. Our related expert staff have been continuing their inspection activities in line with the identified legislation throughout the discussion

meetings and have been transferring their findings to TAI staff. A comprehensive meeting on the certification of avionic devices was held with Aselsan. Aselsan has been informed on the items that needed to be addressed in accordance with the requirements stipulated by the regulations for the company's authorization as the Alternative Design Organization and Production Organization. Regarding the İTÜ-TAI Ultra-Light Aircraft Design Project, a kick-off meeting for the Project was held at our Directorate General with the participation of the representatives of İTÜ and TAI.

Defence Turkey: You recently published a guideline on the Parts and Device Certification in Aviation. With this document that aims to establish a systematic discipline in the industry regarding the design of parts and devices, a new era has started in Turkey. What do you plan to achieve through this document?

Through this document, we aim to render the regulatory requirements more comprehensive and therefore extending production activities regarding aviation to a broader scale within our country. With the help of the PACE (Parts and Devices Manufacturer Inventory) Module that we formed, we plan to form the inventory by registering the companies that are active in production for aviation. With this inventory, the companies authorized by our Directorate General will be able to select from a sole data repository of sub-contractors and real-time monitoring of the development of our aviation potential will be enabled.

Defence Turkey: Technical conformity of Unmanned Air Vehicles, the flight permits according to their categories, and the registration and tracking system for Unmanned Air Vehicles around 500gr – 25kg are being conducted by the Directorate General of Civil Aviation. Could you please inform us on the activities conducted within this framework and on the new regulations?

In line with the Imports Communique No.2018/1, our Directorate General has been granting technical imports conformity for Unmanned Air Vehicles (UAV) imported to our country with the status of air vehicles (Customs Tariff Statistical Position starting with Article 88). In this way, citizens or companies are enabled to import UAVs from the Customs Directorates in





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our country. Additionally, as per the Article 144 of Law No.2920, UAVs with a maximum take-off weight of 500gr and over should be registered. Therefore, registration system software was accomplished and UAVs with up to 25kg of maximum take-off weight are being registered via iha.shgm.gov.tr. Again, the flight permits are being granted over the system via coordination with relevant governmental authorities. Those with a maximum take-off weight of 25kg and over get registration marks similar to Civil air vehicles and then get registered. Our activities regarding the UAV tracking system continue and we are updating our UAV legislation in accordance with global developments as well. Currently, we are conducting our activities in this area by examining technologies that are being used in the world in this particular area.

Defence Turkey: Mr. Kesici, one of the most crucial projects executed by the Directorate General of Civil Aviation is the Turkish Civil Aviation Academy (TSHA) Project. The construction of the Academy was launched in 2016 and the Academy was inaugurated on April 20th. Which deficiencies do you intend to eliminate in Turkey as a direct result of opening this Academy, considering its academicians and administrative staff, curriculum and certification training? Could you please share your evaluations with us?

We inaugurated the Turkish Civil Aviation Academy on 20 April 2018 with the participation of our Minister of Transport, Maritime Affairs and Communication Mr. Ahmet Arslan. This is a project funded by the EU as part of the 'Increasing the Administration Capacity of the Turkish Civil Aviation regarding Safety and Security Training Requirements Project'. All the tender processes of the Project with a budget exceeding approximately 11 million EUR were conducted by the Central Finance and Contracts Unit. Aviation Training in accordance with international standards aligning with the EU Acquis will be provided.

We laid the foundation of this

center on 7 September 2016 at the property of the Atatürk Airport and the center was equipped with the most modern facilities and training devices. Our training center with its capacity of training two thousand domestic and foreign students annually will be a pioneer in respect to civil aviation training in the Middle Eastern, African and Asian countries. In order to train 60 instructors who will be employed at the Academy, "instructor training" courses were provided. Moreover, a requirement analysis was made for the courses to be provided at the training center and training material was prepared. This training center bears the character of a door that opens our country to the world as trainees from all around the world will be attending the classes and it will promote our country as well as our civil aviation industry.

Defence Turkey: We observed that in 2016, the number of personnel employed by the aviation industry reached over hundred and ninety thousand. The increasing number of airline companies active in the industry in addition to the increasing infrastructure and fleet investments, we witness this industry's rapid growth to be on a global scale. Within this scope, what is the Directorate General of Civil Aviation's approach and strategies to create a well-educated, trained and qualified labor force? Do you have any encouraging implementations and activities geared toward increasing the main branches regarding civil aviation especially within universities?

Fulfilling the requirements and expectations of the aviation industry and catering to the increasing demand for qualified staff are among the key factors of aviation. The total number of staff employed in the aviation industry in our country has triple since 2003 and has reached 200 thousand while the number of our pilots increased to 10 thousand and the number of our technicians reached 4 thousand. In addition to the pilots and maintenance staff, 1,597 Air Traffic Controllers, 398 Flight Dispatchers, 545 Air Traffic Safety

Electronic Personnel are operating in the industry. Especially the demand for these licensed staff has been increasing every day as our aviation industry grows.

Starting from this point, we signed a protocol with the Council of Higher Education (YÖK) in November 2012 regarding aviation training and fulfilling the demand for qualified human resources. We made a comprehensive Cooperation Agreement that ranges from opening relevant branches at universities in a way that comprises all the areas of civil aviation and preparing the curriculum for specialization and industrial analysis studies.

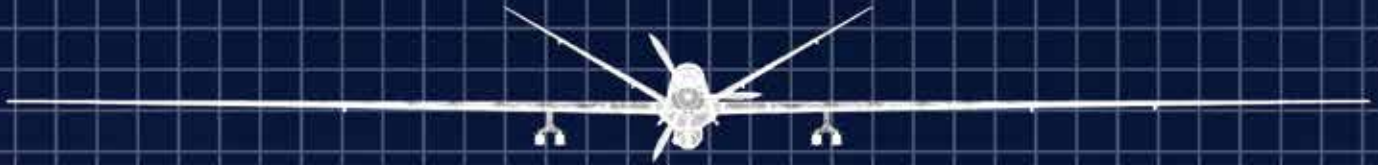
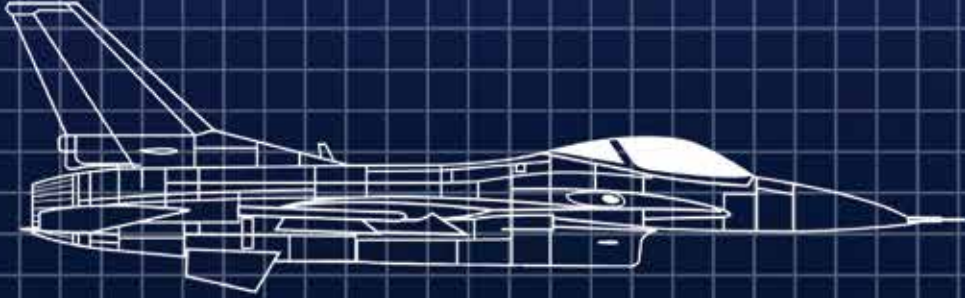
The aviation industry is preparing for a new employment boom with the new airport. Projections have been made of employment for 100 thousand people as the first phase of the third airport is completed and employment of 225 thousand people will be reached when full capacity of the airport is achieved in 2025. With the training we will provide with our universities at the Civil Aviation Academy, we also strive to contribute to fulfilling this increasing demand for qualified labor.

Defence Turkey: It seems that our country's success in the area of Civil Aviation has paved the way for it to assume active roles in international organizations such as ICAO and ECAC, giving our country a voice in worldwide civil aviation. Could you please inform us on these international organizations, the activities you have been conducting to this end and the tasks you assumed?

First of all, Turkey is amongst the founding members of the ICAO and was selected to the General Council Membership of ICAO in 2016 due to its growth in aviation. Turkey's contributions to the global aviation system and its regional cooperation activities have generated notable success. We have a voice among the decision-making authorities of global aviation. We are also amongst the founding members of ICAO's regional (Europe) organization of the ECAC. We also conduct the Vice Presidency



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of the ICAO Europe North Atlantic Regional Aviation Safety Group that has 57 members, which supervises the implementation of decisions adopted by the ICAO regarding aviation safety in Europe.

We are a member of the EUROCONTROL with 41 members in charge of developing European air traffic management and security and we are the Vice President of the D-8 Countries Civil Aviation Commission. Additionally, we are a member of the JAA –TO which was established in order to fulfill the requirement of maintaining European aviation safety. In addition to these associations, our cooperation continues in line with the protocols we signed with the EASA, ACI and IATA.

Defence Turkey: The Eurasia Air Show will be taking place this year in Antalya for the first time on 25 - 29 April 2018. Many local and international aviation companies will be displaying their air vehicles both at the static area and at flight demonstrations as part of this event. What type of support are you providing to this Air Show as the Directorate General of Civil Aviation?

Similar to every event that will support global recognition of Turkish Aviation, which has been rapidly developing in recent years and that will allow new market opportunities to the Turkish Aviation Industry, we also support the Eurasia Air Show event. In line with our Minister Mr. Ahmet Arslan's directives, the Turkish - Asia Civil Aviation Conference will hold in order to open the doors of the developing Asian markets to the aviation operators of our country, has been planned prior to the Eurasia Air Show with the thought of a potential mutual synergy. Representatives at the level of Ministers, Deputy Ministers and General Managers from approximately 40 countries and the Council President, Executives of the ICAO and major names of the worldwide civil aviation will be attending the Eurasia Air Show 2018 after our conference and will thus contribute to this grand aviation exhibition.

In addition to our support in respect to tourism and the promotion of our country, the

announcement of the Eurasia Air Show to the international public and increasing the number of the participants, we will also be holding SHGM conferences as part of the Eurasia Air Show.

Defence Turkey: As the Directorate General of Civil Aviation, you will be broadly participating in the Eurasia Air Show. Which type of events and workshops do you plan to hold that are specific to this organization?

Within the scope of the Eurasia Air Show 2018, as the Directorate General of Civil Aviation (SHGM) we will be holding a series of events which will be accomplished in an effort to create professional and social access and awareness and we believe that it will attract great crowds. Under the title of the SHGM Conferences, we will be holding a series of conferences which will last throughout the day, each day during seven sessions topics will be addressed regarding the most frequently asked questions in civil aviation. Subjects and procedures that are most inquired about by industrial associations, professionals and aviation fans will be shared with the participants directly by the authorities.

The topics will consist of many subjects such as; Turkish Civil Aviation Training Center, How to be a Pilot?, How to be a Cabin Attendant?, What are the Health Requirements for Being a Pilot?, 147 Recognized Schools, How to be a Sub-Contractor of the Design and Production Organization?, 145 Maintenance Organization Notification, Effects of the Aviation Industry to the Environment and the Measures to be Adopted, Air Vehicle, Power Group Certification, Parts/ Device Certification, UAV Registration System and Flight Permit Process, Cyber Security in Aviation, Control of the Constructions around the Airport as part of the Airport Mania Plan and Removal of the Obstructions, Air Navigation Systems and Obstruction Criteria. Our series of conferences that we believe will be the first and taking a notable place in Turkish Organizations can be followed at the SHGM's Conference Hall at the stand of our Ministry.

Defence Turkey: Mr. Kesici, finally do you have any messages for the readers of Defence Turkey?

Turkey's greatest potential in aviation is without a doubt the advantage it has due to its geographical position and additionally due to its high tourism rate and demographic potential as well as its increasing business and trade volume in parallel with its speed of increasing economic development. With the new steps taken in aviation technologies and in the aviation industry, our country has been strengthening its position in civil aviation. All these factors enable the sustainable growth affecting our potential in the future in addition to the development of our civil aviation. Yet, these are not sufficient alone as the main component allowing the sustainable growth of our aviation is the effective utilization of our human resources. If our country utilizes its potential properly, it will make its mark on greater achievements.

We are aware of the fact, that as much as it is a useful area of interest and an occupation particularly for our youth, a generation with such interest will be the greatest and most critical assurance of the aviation industry. As the Director General of Civil Aviation, I advise parents to direct their children, whether their daughters or sons toward aviation starting from the sportive, amateur and cultural activities of aviation. I believe that intellectual activities such as commercial fair events and conferences are crucial platforms toward achieving the target with our great leader Atatürk's motto "the Future is in the Skies". I invite all of our citizens, ranging from the age of 7 to 70 to take part in such activities that gather major figures of Turkish and the aviation society worldwide, in order to become exposed to aviation, to learn and find answers to their questions.

I would like to thank Defence Turkey Magazine for giving me this opportunity and I would like to wish your magazine success as I also wish it to initially meet its readers as "Defence and Aviation Turkey" and then as "Aviation Turkey" ■

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Leonardo's New Operating and Organization Model Optimization Plan 'Leonardo 2.0'

Doubling their network of international branches, joint ventures and subsidiary companies, Turkish industry's strategic partner Leonardo looks forward to new opportunities in the future to cooperate with Turkey, a longstanding relationship built on trust and good industrial relations.

With plans to open at least 20 new offices around the world, mainly in the Middle East, Africa and Asia, Mr. Lorenzo Mariani - Chief Commercial Officer, Leonardo discusses his new role and the company's commercial strategy in an exclusive Defence Turkey interview; boosting international business development activities, cross-business customer support and effective governance of technological innovation by "physically" moving closer to their customers and industrial partners

Defence Turkey: Mr. Mariani, first of all we congratulate you on your new position. Could you please share your new vision, strategies and plans for Leonardo's commercial activities following your assignment?

Thank you, it is a challenging role and I like this kind of challenge. The new commercial organization – made official with my appointment as Chief Commercial Officer in October 2017 – should be considered within a wider framework, specifically Leonardo's 2018-2022 Industrial Plan, presented at the end of January 2018. The Plan – strongly backed by CEO Alessandro Profumo – aims to set the basis for the company's long-term sustainable growth and, of course, commercial strategy is one of the crucial factors in achieving this.

"Leonardo 2.0" has a new operating model focused on optimization, starting with a central organizational structure which can coordinate businesses activity and share/generate best practices, as well as to create a stronger identity and a more integrated resource management.

The Industrial Plan has a challenging but realistic order intake goal of €70 billion over five years, and we expect that more than 60% of it will come from international markets – those excluding Italy, the UK, the US and Poland, which we consider "domestic markets". One of the first activities carried out by the new CCO team was a deep screening and review of all almost 250 marketing campaigns involving Leonardo. We defined the "key campaigns" and we centralized coordination of what we call "strategic campaigns", around 70 internationally, for a total value of €20 billion (excluding US campaigns).

An in-depth assessment of our business and technology was also carried out with the objective to determine our current competitive positioning and identify the key enablers for long-term sustainability and the on-going competitiveness of our



M-346 and M-345 Trainer Aircraft

business lines. Today, Leonardo's commercial proposal is based on a strong and innovative product portfolio, characterized by clear leadership in some business segments. But we know we must concentrate our efforts on building up an even more solid offer, based on three core businesses: Aeronautics, Helicopters and Defense Electronics.

A more effective commercial strategy has to go together with a more effective approach to our customers, including boosting our international business development activities, cross-business customer support and effective governance of technological innovation. To do this, we also need to be "physically" closer to our customers and industrial partners. That's the reason why we have decided to more than double our network of international branches, joint ventures and subsidiary companies.

We plan to open at least 20 new offices around the world, mainly in the Middle East, Africa and Asia, ten of them to be inaugurated between 2018 and 2019. Of course, we also continue to strengthen our existing international offices, including the one we opened in 2010 in Ankara, and not forgetting our Turkish subsidiary, Selex ES Elektronik Turkey AS.

Defence Turkey: How do you assess Leonardo activities in 2017 in terms of

export, programs, investment, production, R&D etc.?

In the last year, Leonardo has seen strong growth in terms of image, effectiveness and industrial efficiency. The Company is solid, and we can call 2017 a consolidation year, almost in line with expectations although a bit tougher than originally expected. At the same time, we achieved some important goals. We saw good commercial performance in the Electronics domain, thanks in part to the deal to supply sensors, naval systems, combat systems and related logistics support for seven Qatari Navy units and a contract with the UK Ministry of Defense that will involve upgrading identification-friend-or-foe (IFF) systems on more than 350 British air, land and naval platforms to the new Mode 5 standard. We also achieved very good results in our Aeronautic programs: we launched the Fighter Attack version of our M-346 aircraft, we delivered six M-346 trainer aircraft to the Italian Air Force, and we completed the supply of eight M-346s to the Polish Air Force, which just ordered four more with options for an additional four. We also received an order from the Italian Air Force for the first batch of five new M-345 trainer aircraft. Together with the M-346, these two aircraft types will form the world's most advanced training system for military pilots. Our AW139 helicopter continues to be the best seller in its category. The

500th Eurofighter Typhoon was delivered to the Italian Air Force and upgrade work on the C-27J multi-mission aircraft continued, including avionics upgrades and new winglets.

We also had good results in our Space activities, and we can confirm the Turkish earth-observation satellite "Göktürk-1" has entered its "pre-operation" phase and is currently used by the Turkish Air Force; the transfer of ownership of the satellite Assembly Integration and Test Center realized at TAI for the customer was also formalized. System qualification is expected during the first half of 2018.

Our investment in R&D increased to 13.4% of revenue, compared to 11.4% in 2016, with activities divided into two main areas: an investment plan looking at strategic and innovative technology and skills, with a medium-to-long-term time horizon, and product development, both the continuous improvement of existing products and for new designs. Examples from 2017 include our starting of the development of a new helicopter, the AW249, for the Italian Army and a successful trials campaign for our SW-4 Solo Rotary Unmanned Air Vehicle (RUAV), flying without a Safety Pilot on-board. In the aforementioned C-27J program, a new baseline configuration is in development, which will include the installation of winglets.

We also started the development of a new product to protect troops from Radio-Controlled Improvised Explosive Devices (RC-IEDs) and we developed a prototype of a new 76mm above-deck cannon, conducting preliminary tests and shooting range trials.

Looking at this year, just a few weeks ago we signed a deal with Qatar for the supply of 28 NH90 helicopters, worth more than 3 billion for the consortium. If 'well begun is half done', we expect further business opportunities to be finalized and we predict 2018 will see us growing, with more orders, revenue and profits.



SW-4 Solo RUAV

Defence Turkey: Could you please inform us about your strategies and future plans for the Turkish Market?

Turkey is a key market for Leonardo, not only because of its increased spending on defense projects, but mainly because we are long-term partners and have achieved good business results together. Leonardo's technologies provide security for the people of Turkey on a daily basis, for example via the new air traffic management and control system which links over 20 air traffic control towers with Ankara's main operations center. Or Leonardo's Vessel Traffic Management System (VTMS), which ensures the safety of Turkey's coast line and seaports, providing an integrated and comprehensive view of maritime traffic in its territorial waters.

The pillars underpinning Leonardo's strategy in Turkey are our commercial and industrial presence and our strong and growing technological partnerships with Turkish companies. Leonardo has been present in Turkey for a long time with a fully-owned Turkish company, Selex ES Elektronik Turkey AS, producing communications equipment for the Turkish Navy and Army. We also have a representative office in Ankara, which today is even more customer-oriented than ever before thanks to a number of colleagues, those in charge of lines of business, who have settled here.

Leonardo wants to be involved in the major Turkish programs related to security and aerospace, both in the civil and defense domains. We have the field-proven technologies that Turkey needs, and we are ready to share our experience. Of course, one of Leonardo's priorities is to further improve the existing strategic cooperation arrangement we have with Turkey's defense industry, including those with Small and Medium Enterprises (SMEs), investing together with Turkish companies both for returns in the domestic market and to jointly challenge new export markets.

Defence Turkey: Turkey and Italy accomplished a success partnership within T129 "Atak" program and in addition Italy fulfilled the commitment of technology transfer in this program. Thanks to this heritage, do you plan to keep the same approach for the up-coming potential joint programs?

The T129 "Atak" program is one of the most successful results of the industrial partnership between Leonardo and Turkish industry, delivering unprecedented operational capabilities and industrial benefits to Turkey. Leonardo has demonstrated that we are a reliable partner and are therefore ready to build on this longstanding collaboration to seize new opportunities in the future relating to a wide range of potential programs, in the helicopter sector as well as in other fields.

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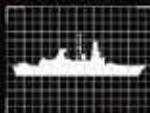
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Defence Turkey: As it is known, Leonardo has great capabilities in radar technology. How do you assess your cooperation with Turkey on radar issues? Could G2G level cooperation be considered in the coming period?

Turkey has indeed grown significantly in its high technology capabilities for many years now. It is a matter of fact that the Turkish defense industry has been well supported by local Government in terms of R&D funding, which has led to very good results in terms of design and development of products, systems and solutions that can effectively compete in the market.

The increasing demand in the marketplace for very sophisticated and high-performance equipment in the field of radar systems has led the Turkish Industry to seek reliable partners with state-of-the-art technology. Leonardo is currently discussing possible cooperation in this field with Aselsan, aiming to meet current and future Turkish Armed Forces requirements, as well as targeting export markets.

The support of Turkish, Italian and UK Governments will definitely contribute towards the efforts that Leonardo and

Aselsan are devoting to building a fruitful and long-lasting high-tech partnership.

Defence Turkey: Leonardo is involved in Liaison and General Utility Aircraft tenders in Turkey with the Spartan C-27J aircraft. Could you please elaborate on the outstanding features and share your approach on this project?

Turkey is looking for new assets that will satisfy their tactical transport requirements and, at the same time, those that can be used for multi-mission operations. We believe our C-27J is the most effective multi-mission airlifter available on the market today,

and we think Turkey deserves the best military platform for the challenging scenarios in which the country operates. We see Turkey as a partner, not just as a customer, and with the C-27J Leonardo is ready and willing to establish long-term partnerships with Turkish industry, both in engineering and commercial aspects.

The C-27J Spartan has an outstanding cabin size, allowing large vehicles such as ambulances or small helicopters to be transported, as well as large NATO pallets or up to 60 fully equipped soldiers or paratroopers. It can interoperate



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with heavier airlifters like the C-130 and the A400M. The cabin can be easily re-configured and in just few hours, you could for example switch between a VIP aircraft and a cargo transport, or vice versa. This ability makes this aircraft the most versatile in its category. The Spartan has unrivalled maneuverability, climbing and descending performance and is qualified for short take-offs and landings on unprepared airfields or in snowy and sandy weather conditions.

It is worth mentioning again that we have developed a new configuration for the C-27J, which will be tested and qualified in



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2018 and will be available in 2019. New C-27J customers will enjoy more modern avionics, reduced operational costs and improved aircraft performance, while the aircraft's fly-away price will be maintained.

The C-27J has a long track record of performing missions with prestigious Air Forces in a range of scenarios including tactical transport operations, disaster relief and search and rescue. It has been chosen by the US Coast Guard and the US Army, as well as several other customers including the Air Forces of Italy, Australia, and Peru.

Defence Turkey: TF-X is one of the significant programs on Turkey's agenda. As we are aware, Leonardo is eager to be involved in this program with the wide range of critical systems.



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Could you please discuss the details about your activities in this regard?

First, it's important to note that the TF-X will be an advanced '5th generation' stealth platform which will be performing an air superiority role on tomorrow's battlefields. As all fast-jet crews recognize, sensors and avionics will be critical to success in these information-driven air combat scenarios. This is where Leonardo comes in. We have 60 years of experience and expertise in supplying avionics for the most advanced combat aircraft to customers such as the Italian Air Force and the UK's Royal Air Force. We are very interested in putting this heritage to work, supporting Turkish industry to deliver TF-X.

One good example of a major fighter program where Leonardo is playing a leading role, the radar, electronic warfare defensive suite and InfraRed Search and Track (IRST) for all Eurofighter Typhoons are delivered by our Company, including for the Air Force of Kuwait, who will

receive the highly-advanced new Leonardo-led E-scan radar. We could translate this experience into assisting Turkish Industry with the TF-X 'integrated RF' and 'integrated EO' packages. In fact, partnership is particularly important for Leonardo in Turkey, on TF-X and elsewhere. We do not want to just sell a product, but rather work alongside Turkey's quickly-developing defense electronics Industry to reduce the schedule and cost risks associated with developing advanced technologies such as IRST and E-scan radar.

Defence Turkey: As it is well known that former OTO Melara made solid achievements in naval projects in Turkey. Could you please inform us about activities performed over the years in Turkey? What is your approach to new naval projects like MILGEM 5-8, TF-2000 (Anti-Air Warfare Frigate) and the Turkish Type Fast Patrol Boat?



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The Turkish Navy is a key customer for Leonardo. Over the years, around 60 naval defense systems, including 76/62 Compact, 40L70 Twin Compact, and 30mm MFCS, have been provided for different classes of vessels. For the MILGEM program follow-on, Leonardo is supporting the 76/62 Super Rapid naval gun configured to operate Strales guided ammunition, while for TS-2000 Leonardo is proposing the 127/64 naval gun, configured to operate Vulcano GPS guided ammunition.

We are also promoting our KRONOS radar systems, a multi-functional radar family which is highly flexible and utterly reliable. The main role of the KRONOS radar system is to monitor surrounding airspace to detect, track and identify targets and to provide the weapon system with target indication, including TBM (Tactical Ballistic Missile) defense capabilities.

Defence Turkey: Turkey has strengthened its position in different markets like Qatar, Pakistan, Saudi Arabia. Naval vessels like MILGEM export sales are on the agenda recently in these markets. What is your opinion about the cooperation for 3rd markets?

The markets you are referencing are ones in which Leonardo has been operating successfully for many years, in the naval sector as well as other domains. In these same markets, Turkey has many interests and its industry is developing important projects. In this scenario, we are willing to develop commercial partnerships. In the naval segment we have already proposed our combat system to some Turkish shipyards, as well as offering some of our subsystems to complete the Turkish proposal. The benefits for the end users are obvious.

At the same time, we hope that a similar business model could see success in other countries, for instance in Central Asia and Africa, and the MILGEM program is just one example of the great potential for Leonardo and Turkey engaging on common projects.



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127/64 Naval Gun

Defence Turkey. Turkey has significant land vehicles programs on its agenda.

Could you please discuss your activities regarding the company's land weapon systems approach in the Turkish market?

In the land domain, Leonardo is teaming with Turkish Industry to pursue opportunities in the international market. In the last few months, we have met all major manufacturers of land vehicles in Turkey – including BMC, Otokar, Nurol, FNSS and Katmerciler – to present our Remote Weapon Station solutions, our land turrets and our EO and Radar sensors. Our greatest interest is to set up collaborations for projects in third countries, without of course neglecting cooperation on programs related to the Turkish market.

Defence Turkey: Selex ES Turkey, a subsidiary of Leonardo, has been conducting activities in Turkey for many years, however not always with excellent results. Do you have any plan for Selex ES Turkey in the new Leonardo international organization?

The relatively strong and improved results of Selex ES Elektronik Turkey AS, which reflect investment and a significant turnaround effort in the last few years, have resulted in a growing number of high technology products that are now manufactured, supported and sold directly by Selex ES Elektronik Turkey AS to the Turkish market and to other export markets.

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equipment, Selex ES Elektronik Turkey AS, under strong Turkish management, now provides services for many of Leonardo's electronic systems installed throughout the country. It is also active in defense, civil avionics and naval message handling systems, which includes the development of indigenous Turkish products.

Leonardo's new business organization activities will of course affect Selex ES Elektronik Turkey AS and the company will be involved in all the new local programs, under new central coordination. As such, the company will be rebranded to become Leonardo Turkey, extending its capabilities to support all areas of Leonardo's portfolio.

Defence Turkey: What is your assessment of Leonardo's partnership with various Turkish companies performed over the years? Could you please elaborate on some details regarding accomplishments resulting from your commitment to off-set obligations in Turkey?

Leonardo has been partnering with Turkish industry for many years now and we value the collaborations we have built over that time. This has created mutually beneficial relationships involving SME's and major Turkish suppliers across a range of capabilities from aero-structures and mechanical manufacturing to training, engineering services and investment, supporting many Leonardo activities. A significant example is our collaboration with TAI which led to it becoming the only company outside of Leonardo capable of manufacturing fuselages for our AW139 helicopter. TAI has now delivered more than 300 units to-date. The potential and desire is there to continue to extend these relationships where there is good business reason to do so. Leonardo takes its offset obligations very seriously and actively seeks to find innovative solutions that comply with requirements but also those that deliver the mutual, sustainable



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AW 139 VIP Helicopter

economic benefits both parties expect. Through this approach, Leonardo has already delivered more than fifty percent of its offset obligations and has mature plans to discharge most of the outstanding obligations over the next four years.

Defence Turkey: Lastly, are there any remarks that you would like to share with the readers of Defence Turkey Magazine?

Leonardo has been doing business in Turkey for more than forty years, participating in major civilian and military projects such as the T129 helicopter, the Meltem-3 coastal patrol program,

naval sensors and defense systems and more recently the "Göktürk" satellite program. Our experience in Turkey allows us to present ourselves as a strategic partner for Turkish industry in the aerospace, defense and security sectors. Leonardo has already proven that we can develop and offer world class technologies and products to Turkey, including satellites, helicopters and advanced civilian and military electronics. Based on all these references, I expect Leonardo to gain new opportunities in the future to cooperate with Turkey, which will benefit from trust and good industrial relations ■



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Mr. Lorenzo Mariani - Chief Commercial Officer of Leonardo met with Mrs. Ayşe Evers - Editor in Chief of Defence Turkey Magazine at DIMDEX 2018, Qatar

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5th Generation Fighters and the TF-X Program

Since the 1990s Fighter Jets have been classified and categorized in 'generations' from technology perspective, with each new generation reflecting a major advance in technology and capability

The term 'generations' applies to only jets rather than propeller driven fighter aircraft. During the 2000s Aerospace companies have also preferred to use generation-based categorization in order to differentiate between 'old' and 'new', fighter jet designs and capabilities and in a short time the notion of aircraft generations has turned into a marketing terminology. Lockheed Martin, for example, has labelled the F-35 Joint Strike Fighter a "fifth-generation" fighter in 2005, a term it borrowed from Russia in 2004 to describe the F-22. As a powerful marketing tool, the term 'fifth-generation' has been applied to the F-22 and F-35 aircraft, to underline that competing companies could not offer similar levels of performance and technological capabilities.

However, even the 'generations' are supposed to be defined by new game-changing capabilities, since the evolving combat capabilities and requirements blur generational lines there is no clearly defined line between successive generations. Generational shift in fighter jets occurs when a technological innovation cannot be incorporated into an existing aircraft generation through upgrades and retrofits. Among the generational lines focus is shifting from platform to system-of-systems and each generation represents certain class of technology used in the fighter jet such as avionics, software, construction materials, network capability, engines, etc. A higher generation means a more technologically advanced platform.

Since there is no central authority giving out these designations, there is no accepted or objective definition of aircraft generations therefore the exact characteristics of the fighter jet generations are controversial and vague. Never the less we can summarize, or define the various generations of jet-powered fighter aircraft as follows:

First-Generation (mid 1940s to mid 1950s)

Generally, this refers to the introduction of subsonic fighter jets, first introduced in late World War II and

with jet engines and gun armament such as the F-86 and MiG-15. A common characteristic of this generation of fighter jet was that the jet engines did not have afterburners and the aircraft operated in the subsonic regime.

Second-Generation (mid-1950s to early 1960s)

This generation is generally considered the mid 1950's to early 1960's, when afterburning turbojet engines entered production. The second-generation fighters saw the introduction of air-to-air radar, tail-aspect IR and semi-active radar guided missiles, as well as radar warning receivers into such aircraft as the F-104, F-5, MiG-19 and MiG-21.

Third-Generation (early 1960s to 1970)

The 1960s to approximately 1970 produced aircraft with increased maneuverability and ground attack capabilities, combined with the introduction of guided missiles. The F-4 Phantom and MiG-23 are examples of third-generation aircraft. Doppler radar supported a 'lookdown/shoot-down' capability, and with off-bore-sight targeting and semi-active radar guided missiles like the AIM-7 Sparrow and AA-7 Apex, aerial engagements moved to beyond visual range. The major change brought about by this generation aircraft was that it was no longer necessary to visually acquire opponents to neutralize them and gain control of the air.

Fourth-Generation (1970 to mid-1990s)

Between approximately 1970 and the mid-1990s, aircraft were characterized by their multi-role configurations and equipped with sophisticated avionics and weapons systems. Common characteristics of this generation of fighter jets were; 9G capability, turbofan engine, HUD, glass cockpit, computer technology, thrust to weight ratio of 1.1 or more and multi-target engagement capability. The F/A-18A Hornet, MiG-29, Su-27, F-16C/D

and JAS-39 are examples of the fourth-generation fighter aircraft.

Four-and-a-half Generation (mid-1990s to 2005)

The terms fourth-plus or four-and-a-half generation have been used to encompass fourth-generation aircraft with fifth-generation capabilities. This generation of aircraft from the mid-1990's until 2005 are often modified fourth-generation aircraft with significantly enhanced capabilities. The US FY2010 Defense Authorization Act defined four-and-a-half generation as current aircraft, including the F-15, F-16 and F/A-18, that have advanced capabilities, including active electronically scanned array (AESA) radar, high capacity data-links and enhanced avionics, and have the ability to deploy current and reasonably foreseeable advanced armaments. They are commonly identified by signature reduction, helmet-mounted sights, GPS-guided weapons and highly integrated systems. The F/A-18E/F Super Hornet, F-16E/F/V, JAS-39N, F-15E/SA, Rafale, EuroFighter, MiG-35 and Su-35 are examples of a four-and-a-half generation fighter aircraft.

Fifth-Generation (2005 to date)

Combining new developments such as thrust vectoring, composite materials, super cruise (the ability to cruise at supersonic speeds without using engine afterburners), stealth technology, advanced radar and fully integrated avionics and sensors, the fifth-generation fighter aircraft are characterized by low observability (including the use of internal weapons bays), vastly improved situational awareness through a network-centric combat environment and the design ability to act as an integrated data node. The era of the 5th Generation Fighter Jet was ushered in with the introduction of the USAF F-22 Raptor air superiority platform in 2005. Several Fifth Generation Fighters are in development including the US F-35 Lightning II, Chinese J-20 and J-35, the Russian T-50/Su-57 PAK-FA, Korean KF-X and the Turkish TF-X.

As of March 2018, the only fully-operational and combat ready, Fifth-Generation Fighters are; the Lockheed Martin F-22 Raptor, which entered service with the USAF in 2005; the Lockheed Martin F-35 Lightning II, which entered service in 2015 and the Chengdu J-20, which entered service with the People's Liberation Army Air Force (PLAAF) in September 2017. Whereas, the Sukhoi Su-57/T-50 is scheduled to enter Russian Air Force service in 2019. The KF-X, Shenyang J-31 and TF-X are currently under early stages of development process.

In order to minimize their Radar Cross Section (RCS), all fifth-generation fighters use chines instead of standard leading-edge extensions and lack canards, and they all have twin canted vertical tails (similar to a V-tail) also to minimize side RCS. Most fifth-generation fighters features super maneuverability that achieved through thrust vectoring capability on the engines. All fifth-generation fighters have internal weapon bays in order to avoid high RCS weapon pylons, but they all also able to fitted with external hard-points on their wings for use on non-stealthy missions, such as the external fuel tanks the F-22 carries when deploying to a new theatre. All fifth-generation fighters have a high percentage of composite materials, in order to reduce RCS and weight. All known fifth-generation designs have extensive electronic warfare systems. Thanks to their great radar (AESA) and sensor fusion features and all-aspect stealth characteristics the fifth-generation aircraft can perform their mission anywhere, even in sophisticated integrated air defense environments. Their all-aspect, day/night low observability (stealth) feature minimizes their exposure and susceptibility to enemy's advanced SAM systems and allows them to hold enemy targets at risk and to engage air threats before detection. Stealth feature provides fifth-generation fighter jets first look, first shot and first kill advantage over their older generation adversaries. Due to their network-centric combat capabilities the fifth-generation fighter jets will be able to operate together in a 'combat cloud' along with future unmanned combat aircraft (UCAVs).

So, 5th generation fighters provide air superiority and global precision attack against today's, and tomorrow's air and ground threats.



Fifth-Generation Fighters

F-22 Raptor

F-22 Raptor is a fifth-generation single-seat, twin engine (F119 turbofans), all-weather stealth tactical fighter aircraft developed by the Lockheed Martin for the USAF. F-22 Raptor production began in 1994. During Engineering and Manufacturing Development (EMD) Phase, nine F-22s were delivered. The first EMD phase F-22, named Raptor 4001, was unveiled at Marietta, Georgia, on April 9, 1997. However, due to software and mechanical delays the series' first flight was pushed until September 7, 1997. Second F-22 flew on June 29, 1998.

The first combat-capable Block 3.0 aircraft first flew in 2001. In August of 2001, the United States Department of Defense (US DoD) ordered a full low-rate production. In 2004, the F-22 completed its Operational Test and Evaluation Centre Program with the USAF, which led directly to Full Rate Production being achieved in 2005. The first operational F-22 squadron was formed in 2005 with the F-22A officially entered USAF service on December 15, 2005. In April 2006, the Government Accountability Office (GAO) assessed the F-22's cost to be US\$361 million per aircraft, with US\$28 Billion invested in development and testing. As of late 2010, there have been 168 of the 187 contracted F-22s delivered to the USAF at a cost of US\$143 Million to US\$150 Million. The last F-22 was delivered to the USAF in 2012. The F-22 was in production for 15 years, at a rate

of roughly two per month during peak production. The F-22 was designed for a lifespan of 30 years and 8,000 flight hours.

Thanks to its unmatched speed, altitude and maneuverability the F-22 Raptor is optimized for air dominance and provides uncompromised air-to-air performance. F-22 Raptor can internally carry twice the air-to-air ordnance (6 AIM-120 + 2 AIM-9 vs 4 AIM-120) of an F-35A.

F-22 Raptor is powered by a pair of Pratt & Whitney F119-PW-100 thrust vectoring turbofan engines each delivering up to 35,000lbs of full thrust. When running on normal thrust conditions, the F-22 does not leave a noticeable smoke trail with its double-engine arrangement. The engines further provide the F-22 with a top speed of over 1,500 miles per hour (Mach 2.25) at altitude and, when on super cruise, the F-22 can hit speeds of 1,200 miles per hour (Mach 1.8). Operation range is reportedly at 2,000 miles with a combat radius of 470 miles - more so with external fuel stores in place. The F-22 can hit a service ceiling of 65,000 feet and up to 9G of gravitational force. Internal fuel volume (18,030lbs) is stored across eight tanks that are filled with nitrogen to reduce the danger present from combustible fuel fumes.

In addition to its stealth-minded loadout, the F-22 can carry external ordnance at the expense of a greater radar signature. 4 x AIM-9 Sidewinder missiles can be fitted as pairs across two outboard underwing hard-points for a grand total of twelve missiles (eight internally and four externally). 2

x 600 US gallon Drop tanks for increased operational ranges can be fitted on inboard underwing hard-points as well - this to serve the F-22 well in long loitering times or lengthy interception sorties.

Despite its origins as an air dominance fighter, the F-22 has evolved into a dual-role mount capable of precision strike sorties through the utilization of air-to-surface weaponry. A standard outfit is 2 x AIM-9 and 2 x AIM-120 air-to-air missiles for self-defense along with 2 x 1,000lb JDAM (Joint Direct Attack Munitions) laser-guided bombs for ground strikes.

The F-22 is fitted with the Northrop Grumman AN/APG-77 AESA radar system and an integrated BAE Systems AN/ALR-94 Radar Warning Receiver (RWR) and Lockheed Martin AN/AAR-56 IR and UV Missile Launch Detector (MLD). The radar can acquire the most potent threat to the aircraft and engage within 135 miles providing for a "first-shot, first-kill" approach - this without the enemy not even spotted the F-22. The AN/ALR-94 RWR's range (250nm+) exceeds the AN/APG-77 AESA radar's range and can be used as a passive detection system capable of searching targets and providing enough information for a radar lock on.

Compared to previous stealth designs like the F-117, the F-22 is less reliant on Radar Absorbent Material (RAM), which are maintenance-intensive and susceptible to adverse weather conditions. Unlike the B-2, which requires climate-controlled hangars, the F-22 can undergo repairs on the flight line or in a normal hangar. The F-22's exact RCS is classified; however, in 2009 Lockheed Martin released information indicating it has an RCS (from certain angles) of -40dBsm (decibel relative to one



F-22 Raptor

square meter), equivalent to the radar reflection of a "steel marble".

F-22 Raptor stealth fighters took part in Operation Inherent Resolve, military intervention performed against ISIL both in Syria and Iraq. Operation Inherent Resolve was launched on 22 September 2014 and the F-22s performed the type's first combat sorties during the US led intervention in Syria. By January 2015, the F-22 accounted for three percent of USAF sorties during Operation Inherent Resolve. Until May 28, 2017 some 1,150 F-22 sorties had been flown of which 497 were Close Air Support (CAS) sorties, with the F-22 fighters delivering GBU-32 JDAM precision-guided munitions and GBU-39 SDB (Small Diameter Bomb) glide munitions. During 497 CAS sorties F-22 fighters delivered a total of 1,572 munitions. Since it is practically invisible, the F-22 Raptor was able to operate almost freely throughout Syria, despite the threat imposed by the state-of-the-art Russian-made air-defence systems – an impressive accomplishment in itself. During Operation Inherent Resolve F-22 is used as a multirole platform, namely – as a strike fighter and not just as an air superiority fighter.

F-35 Lightning II

The Lockheed Martin F-35 Lightning II is a family of single-seat, single-engine, fifth-generation multirole fighter aircraft. F-35 will be manufactured in three versions: a conventional-take-off-and-landing (CTOL) variant for the US Air Force, an aircraft-carrier version (CV) for the US Navy, and a short-take-off/vertical landing (STOVL) version for the US Marine Corps and the UK Royal Air Force and Royal Navy. Three variants of the F-35 will replace the A-10 and F-16 for the U.S. Air Force, the F/A-18 for the US Navy, the F/A-18 and AV-8B Harrier for the US Marine Corps, and a variety of fighters for at least ten other countries.

The F-35 Lightning II Program has experienced a number of cost overruns and developmental delays. By 2014, the program was US\$163 billion over budget and seven years behind schedule.

The Joint Strike Fighter (JSF) Program was started on November 16th, 1996. Boeing has offered X-32 and Lockheed Martin has offered X-35. The X-35A completed its first flight on October 24th, 2000, the carrier X-35C went airborne for the first time on December 16th, 2000



and the X-35B achieved first flight on June 24th, 2001. Following an intense four-year competition, the US Department of Defense on October 26, 2001, named the Lockheed Martin lead Joint Strike Fighter [JSF] Team as the winner of the contract to develop the F-35 Lightning II. Lockheed Martin is the F-35 prime contractor, while Northrop Grumman and BAE Systems are principal partners in the project. The F-35 team immediately entered the program's System Development and Demonstration (SDD) Phase.

Nine nations have partnered in the F-35's SDD Phase: The United States (USAF 1.763 F-35As, DoN 693 F-35B/Cs), United Kingdom (RAF/RN 138 F-35Bs), Italy (60 F-35As and 30 F-35Bs), the Netherlands (37 F-35As), Turkey (100 F-35As), Canada (65 F-35As), Denmark (27 F-35As), Norway (52 F-35As), and Australia (100 F-35As). International partners of the Program have agreed to contribute US\$4.375 Billion towards development costs. There are three levels of international participation. The levels generally reflect financial stake in the program, the amount of technology transfer and subcontracts open for bid by national companies, and the order in which countries can obtain production aircraft. The UK is the sole 'Level 1' partner, contributing US\$2.5 Billion.

Turkey as a 'Level 3' partner contributes US\$195 Million. In May 2013, Lockheed Martin declared that Turkey is projected to earn US\$12 Billion from licensed production of F-35 components. So far, Turkey has placed an order for a total of 30 F-35As. 2 in Lot 10, 4 in Lot 11 and in October 2016 Turkey Defense Industrial Executive Committee approved the Block Buy for further 24 F-35As over three contract years. Turkey will take delivery of first two F-35As in June 2018 in the US (at Luke Air Force Base, Arizona, where TurAF pilots will perform training on the aircraft, maintainers will receive their training at Eglin Air Base). The first two F-35As will arrive in Turkey in 2019. Located in Malatya, the 7th Main Jet Base will be the first main Operating Base of the Turkish Air Force. 172nd and 171st Squadrons will receive



the F-35As. Israel and Singapore have joined the Program as Security Cooperative Participants (SCP). Israel has ordered 50 F-35As, Japan has ordered 42 F-35A and South Korea has ordered 40 F-35As. Israel declared IOC for the F-35I "Adir" in December 2017. Total development costs are estimated at more than US\$40 Billion. The purchase of an estimated 2,400 aircraft is expected to cost an additional US\$200 Billion.

The first production F-35A (AA-1) Lightning II rolled out of the assembly in Fort Worth, Texas, in February of 2006 and achieved first flight on December 15th, 2006. Low-Rate Initial Production (LRIP) for the F-35A/B was approved in April 2007 with an order for two CTOL aircraft. An LRIP 2 contract for six CTOL aircraft was placed in July 2007. The STOVL F-35B was rolled out in December 2007 and made its first flight, a conventional take-off and landing, in June 2008. STOVL flights began in early 2009. An LRIP contract for six F-35B STOVL aircraft was placed in July 2008. The F-35C took off on its first flight in November 2011.

During 12-year SDD Phase Flight Test Program, the Team has built a total of 22 test aircraft. Fourteen underwent flight-testing, seven were used for non-airborne test activities, and one was used to evaluate the F-35's radar signature.

The F-35 was supposed to complete its SDD Phase and begun its Initial Operational Test and Evaluation (IOT&E) by August, 2017. SDD certification means the aircraft is in a mature state of development with demonstrated capabilities in live-fire exercises.

On April 11, 2018 at US Naval Air Station Patuxent River, Maryland,

Navy test aircraft CF-2 completed the final developmental test flight of the SDD Phase of the JSF Program. According to Lockheed Martin, a team of over a thousand SDD flight test engineers, maintainers, pilots, and support personnel completed full flight-envelope tests on all three variants of the F-35, including six at-sea detachments with over 1,500 vertical landing tests for the F-35B, 183 Weapon Separation Tests, 46 Weapons Delivery Accuracy tests, and 33 Mission Effectiveness tests that included multi-ship missions with eight F-35s taking on advanced threats. One remarkable aspect of this testing program was that it didn't involve a loss of either a single pilot or airframe. Under the developmental flight test program more than 9,200 sorties, accumulating over 17,000 flight hours, have been conducted and more than 65,000 test points have been executed to verify the design, durability, software, sensors, weapons capability and performance for all three F-35 variants. Now that the SDD phase has been completed, the F-35 needs to pass through an Operational Test and Evaluation before the US Department of Defense can give the go-ahead for full-scale production, starting with the Block 3F capability being cleared for operations.

On July 31, 2015, the United States Marines declared ready for deployment the first F-35B squadron after intensive testing. On August 2016, the USAF declared its first squadron of F-35A fighters combat-ready. The Pentagon targeted Initial Operational Capability (IOC) for the F-35C between August 2018 and February 2019.



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Under the F-35 Lightning II Program the first production model of the F-35 Lightning II (F-35A known as AF-6) conducted its first flight on February 25, 2011 and aircraft deliveries also started in 2011. As of April 2018 over 280 F-35 Lightning II aircraft has been delivered to US and international customers, 130,000 cumulative flight hours have been surpassed, more than 580 pilots and 5,600 maintainers have been trained. Under LRIP-10 a total of 358 F-35 Lightning II fighter aircraft in three versions have been ordered. Lockheed Martin has delivered 66 F-35 in 2017 and plans to deliver 91 in 2018, 130 in 2019, 145 in 2020, 150 in 2021 and 2022 and 160+ in 2023. F-35 will remain in the service until 2077.

On February 28, 2018 Wednesday at a round-table event Vice Adm. Mat WINTER, director of the F-35 Joint Program Office, told reporters that of the 280 operational F-35s purchased to date by US and international partners, only 51% are currently available for flight. According to WINTER, availability rates were lowest for aircraft purchased in early lots, which were beset with a number of hardware and software issues that later production lots addressed. LRIP 2 through 4 have availability rates between 40% and 50%, WINTER said. The most recent LRIP lots, 9 and 10, which include aircraft that are still rolling off the production line, have the highest availability rates, 70% to 75%, he said.

The flyaway cost of the F-35 Lightning II is steadily coming down with each production lot. In 2014, the airframe cost went below

US\$100 Million for the first time, and the flyaway cost of the F-35A fell to US\$94.3 Million in Lot 10, which was signed in 2017. The flyaway cost is aimed to be reduced to no more than US\$85 Million for the F-35A in Lot 13.

The Pratt & Whitney F135-PW-100 turbofan engine powers the F-35A and F-35C, F-35B is powered by F135-PW-600. Only the F-35B has thrust vectoring, which can greatly improve maneuverability for dogfighting. The F135 engine is not designed to super cruise. However, the F-35 can briefly fly at Mach 1.2 for 150 miles without the use of an afterburner. The F135 is the second (radar) stealthy afterburning jet engine. The F-35 has a maximum speed of over Mach 1.6. With a maximum take-off weight of 60,000lb (27,000kg).

The F-35 designed with two internal weapon bays, and six external hard-points. The two-outer hard-points can carry pylons for the AIM-9X Sidewinder and AIM-132 ASRAAM short-range air-to-air missiles (AAM) only. The other pylons with a capacity of 2,500lb and 5,000lb can carry the AIM-120 AMRAAM BVR AAMs AAM, AGM-158 JASSM cruise missile, and guided bombs such as GBU-12. The external pylons can carry missiles, bombs, and external fuel tanks at the expense of increased RCS, and thus reduced stealth.

With its multi-spectral active, passive & IR sensors, and increased payload, the F-35 is more capable in air-to-ground role and optimized for Global Precision Attack. The F-35 is drastically more than just a fighter jet; it is a highly integrated air system. The F-35A's advanced

sensor package gathers and distributes more information than any fighter in history, giving operators a decisive advantage over all adversaries. The Lightning II will provide paralleled situation awareness, allowing the pilot to virtually "look through the floor of the fighter or behind the aircraft". Networking will also allow the pilot to see information provided by other aircraft, ships or ground units. Its tremendous processing power, open architecture, sophisticated sensors, information fusion and flexible communication links make the F-35 an indispensable tool in future homeland defense, joint and coalition irregular warfare, and major combat operations.

Fifth-generation fighter capabilities are largely defined by their software capabilities. The F-35 has more software than any other air combat aircraft, with 8.4 million lines of code in the aircraft, and a further 7 million lines of software in the supporting ground systems.

The F-35 is less maneuverable than some fourth-generation aircraft, particularly the Russian Sukhoi fighters, but this deficiency is negated through its all-aspect stealth feature. The F-35 has stealth designed in as part of the aircraft from the beginning. The F-35's advanced stealth allows pilots to penetrate areas without being detected by radars that legacy fighters cannot evade. The F-22 Raptor is probably the only operational aircraft stealthier than the JSF. But the radar cross section of the JSF is at its lowest when directly facing a radar. It then increases as the aircraft turns away from the radar presenting more of its side rather than front. The F-35's exact RCS is classified; however, Aviation Week magazine reports that the F-35 RCS is -30 dBsm or .001 square meters. In June 2016 the F-35 JSF scored an 8:0 kill ratio against the F-15E during mock air combat. It was disclosed in September 2017 that during their 45 minutes lasted flight within the Greek FIR, while heading to Nevatim Airbase in Israel, the two new F-35I Adir fighters of the Israeli Air Force were not detected by any Greek air surveillance radar in the area.

Su-57/T-50 Sukhoi PAK FA

Designed by Sukhoi, the Su-57 (formerly T-50 and PAK FA) is a fifth-generation single seat, twin-engine multi-role fighter aircraft intended to compete with F-22 Raptor. The Su-57 is the first combat aircraft program that is started by the Russian Federation and will be the first aircraft in Russian military service to use stealth technology. In August 2017, Sukhoi revealed that T-50 PAK FA fifth-generation fighter jet had received the serial index of 'Su-57'. Categorized as a 'fifth-generation fighter' the Su-57 is planned to have supercruise capability, stealth/radar-absorbing materials, supermaneuverability, networking, data fusion and advanced avionics. The Su-57 has been experiencing technical problems which caused delays in the program schedule but it is believed that ultimately the Russian Aerospace Industry will be able to resolve the existing technical glitches with the aircraft and field a capable operational aircraft during the second half of the 2020s.

The Su-57 is intended to replace MiG-29 and Su-27 in the Russian Air Force and serve as the basis for the Fifth Generation Fighter Aircraft (FGFA) being co-developed by Sukhoi and Hindustan Aeronautics Limited (HAL) for the Indian Air Force. However according to Indian media in October 2017 the Indian Air Force has reportedly demanded an end to FGFA project. According to Defense News, senior IAF officers are concerned that the new aircraft will not meet desired requirements including RCS/stealth. After evaluating the first T-50/Su-57 prototype the IAF wanted more than 40 changes on the aircraft.

The T-50/Su-57 prototype first flew on January 29, 2010 and according to Russian media as of March 2018 there are 13 Su-57 prototypes. 10th prototype (T-50-10) has performed its maiden flight on December 23, 2017. Prototype aircraft are being used under Su-57 Flight Test Program. Russian Federation is expected to place an order for the first batch of 12 Su-57s for the Russian Aerospace Forces in 2018. Deliveries of first two production aircraft to the Russian Aerospace Forces are to begin in

2019. Su-57s will be produced by United Aircraft Corporation (UAC). The Russian Air Force is expected to procure more than 150 Su-57 aircraft. In December 2014, the Russian Aerospace Forces planned to receive 55 fighters by 2020. Yuri BORISOV, Russia's Deputy Defense Minister for armaments stated in 2015 that the Russian Aerospace Forces will slow Su-57/T-50 production and reduce its initial order to 12 fighters and retain large fleets of fourth-generation (+ four-and-a-half generation fighter aircraft such as Su-35S) fighters due to the nation's economy. The Su-57 aircraft is expected to have a service life of up to 35 years.

The prototypes and the initial production batch (covering 12 aircraft) will be delivered with NPO Saturn AL-41F1 (Izdelye-117) engines, closely related to the Saturn 117S engines used on the Su-35S, as interim engines while a new clean-sheet design turbofan engine (Izdelye-30) is currently under development. Each of the NPO Saturn AL-41F1/Izdelye-117 turbofans, provides 32,500lbs of thrust. According to Russian sources, though the AL-41F1 provides enough thrust for sustained supersonic cruise capability, it does not meet the Russian Aerospace Forces requirements for thrust-to-weight ratio or fuel efficiency. On June 10, 2014, the fifth flying prototype, aircraft T-50-5, was severely damaged by an engine fire after landing. The pilot managed to escape unharmed.

The first successful test flight with a Su-57 (T-50-2 prototype) using the new Izdelye-30 turbofan

engine took place on December 5, 2017 and lasted 17 minutes. But the engine will not be ready until 2025, so the Su-57 will not be ready for serial production until 2027. Little is known about the Izdelye-30 engine, but it will reportedly provide the Su-57 with 39,566lbs of afterburning thrust. It will also improve the Su-57's fuel efficiency (%17-18 more efficient than AL-41F1) and stealth capabilities. The engines also have fewer components and resulting lower maintenance costs and reduced maintenance schedule. Thrust-vectoring will be standard and allow for the required agility. With the new Izdelye-30 turbofans installed, the Su-57 is expected to offer kinematic performance comparable to the F-22 Raptor, cruising without afterburner at speeds exceeding Mach 1.5 with a maximum speed greater than Mach 2.0 at altitudes of around 60,000ft. The Su-57's listed ferry range is 3,400 miles with an operational service ceiling of 65,000 feet. The airframe will support forces of up to 9G.

Standard armament will be one or two 30mm GSh-301 series cannons. Six internal hard-points will be available as well as up to six external hard-points. The internal hard-points will be set across the two (perhaps four in finalized production forms) internal weapons bays found under the fuselage.

The T-50 makes extensive use of composites comprising 25% of the structural weight and almost 70% of the outer surface. Whereas, structural composites in the F-35 are 35% of the airframe weight (up from 25% in the F-22). In 2010, Alexander



DAVIDENKO, Chief Engineer on the T-50 PAK FA Project, claimed that the F-22 RCS was about 0.3 to 0.4 square meters and that the T-50's RCS should be close to that. Military journalist Dmitry LITOVKIN, writing in *Izvestya*, stated that the Su-57/T-50's RCS "will be equal to 0.5 square meters (for the Su-30 MKI, the Indian version of the Su-30, it is 20 square meters". By comparison, Lockheed Martin's F-22 Raptor has the RCS of a small bird or a bumble bee at between 0.001 and 0.01 square meters.

The Su-57 features an extremely complex and fully integrated avionics suite which will include three X Band AESA radar (one main and two side-looking), another two L Band AESA radars in the wing's leading-edge extensions, plus an integrated Electro-Optical (EO) System location system (working in IR, visible and UV frequencies). All these sensors are fused (5 radars, 2 bands, plus passive optics) and they are then combined with the data received by the Su-57's advanced EW suite and a high-speed encrypted datalink, connecting the aircraft to other airborne, space, as well as ground-based sensors. The Su-57 will be equipped with the upgraded version of KRET's Okhotnik (Hunter) video image processing system. According to Russian media providing digital image stabilization, auto detecting and auto tracking capabilities the upgraded system (with CCD and IR image sensors) will increase the Su-57's target acquisition range by 50-100 percent under conditions of limited visibility.

In February of 2018 the Russian Aerospace Forces have deployed a number of Su-57 to Syria for testing. Satellite imagery has confirmed at least two (four in some sources) Su-57s has been deployed at Khmeimim Airbase in Syria. On March 1, 2018 Russia's Defense Minister Sergei SHOIGU has confirmed that two Su-57 fighters went to Syria for a series of trials, but these only lasted two days before the planes returned home. "Indeed, they were there for a while. Two days. During that time, they completed a program of trials, including combat ones," Minister SHOIGU said.

The price tag of an Su-57 is quoted as approximately US\$54 Million.

J-20 Black Eagle

Designed and developed by China's Chengdu Aerospace Corporation for the PLAAF the J-20 is a single seat, twin-engine, fifth generation stealth fighter intended to fulfil two roles, long range air superiority and ground attack. China, however, refers the J-20 as a fourth-generation medium and long-range fighter jet.

The J-20 performed its 15-minute lasted maiden flight on January 11, 2011, following the manufacture of 8 prototypes for flight test program the Low Rate Initial Production (LRIP) Phase was started. On January 18, 2016 LRIP version of the J-20, numbered 2101, performed its maiden flight and China declared the J-20 fully functional in May 2017. The first J-20 entered service with the People's Liberation Army Air Force (PLAAF) in September 2017. On September 28, 2017, Chinese Ministry of Defense spokesperson Wu QIAN stated that the J-20 "has been officially commissioned into military service." As of January, 2018 it is believed the PLAAF operates 8 J-20 prototypes and 5 LRIP fighter jets. Prototypes and pre-production aircraft are designated 20XX, while production versions are designated 21XX.

A number of J-20s had participated in the Red Sword 2017 war games held in November 2017. In early January 2018 several J-20 stealth fighters took part in combat exercise against fourth-generation PLAAF fighters. According to Chinese media the 9-day lasted exercise witnessed BVR air-to-air

combat maneuvers among J-20, Shenyang J-16 fighter-bombers and Chengdu J-10C multirole fighter jets. In February 2018 China declare that its new stealth fighter J-20 is combat ready.

The prototypes and LRIP Phase J-20s are powered by WS-10B/G and AF-31F turbofan engines. The aircraft's maiden flight was powered by two Russian AL-31 engines, which are less capable than China's WS-10B/G, developed as a stopgap for the J-20. Chinese Aerospace Industries is currently working on an advanced, next-generation high performance domestic turbofan engine coded WS-15. WS-15 project started in the 1990s, with the first prototype delivered in 2004 and the first successful ground-running test staged in 2015. However, the WS-15 engine designed for the J-20 exploded during a ground running test in 2015. China has allocated US\$16 Billion for the development of domestic fighter engines, but it takes time to develop new generation turbofan engine for the fighter jets. Pratt & Whitney and General Electric for example has spent more than 12 years developing prototypes of the F119 engine in the 1980s, followed by another 14 years of testing after the engine's maiden flight, fitted to an F-22, in September 1997.

By 2020 the J-20 is planned to be powered by a pair of WS-16 engine, which will enable the J-20 have supercruise capability. China is not expected to put the J-20 into mass production until the WS-15 project was wrapped up. In addition to engine and its reliability issue, the J-20 Program has been experiencing



technical difficulties in the fields of aircraft control system, stealth coat and hull material an IR sensor. Given that the J-20 currently lacks thrust vectoring it is believed that the aircraft is less maneuverable than the F-22 but it is still more advanced than China's fourth-generation fighters because of its stealth capability and the most able combat aircraft in the service of the PLAAF. PLAAF is expected to receive about 700 J-20 Black Eagle by 2035.

As the first fifth-generation fighter of China, the J-20 represents a critical step in China's efforts to develop advanced aircraft to improve its regional power projection capabilities and to strengthen its ability to strike regional airbases and facilities.

The J-20 has a long and wide fuselage presumably for the use of large amounts of internal fuel stores, advanced avionics capacities and large internal weapons bays. The J-20 contains two lateral bays for small air-to-air missiles such as PL-9 and PL-10 IR missiles and a larger bay under the fuselage for a variety of long-range missiles (can accommodate four PL-15 medium range AAMs or the PL-21 ramjet powered, long range AAMs, similar to the Meteor) and surface attack weapons. This is similar to the weapons bay configuration of the F-22, but different from the Russian Su-57/T-50, which instead holds two small and two large weapons bays.

While there are some visual similarities to the casual observer, further inspection quickly dispels the thinking that the J-20 Black Eagle is an exact copy of the F-22 Raptor. The J-20 makes use of a large-area delta wing design without traditional tail surfaces whereas the F-22 make use of a diamond-type wing arrangement with horizontal tail surfaces aft of the main wing assemblies. The J-20 also features ventral fins and forward canards, two design elements not utilized by any other fifth-generation stealth-minded fighter for they tend to compromise stealth characteristics. The J-20 is significantly larger than F-22 and longer from nose to tail, leading most to assume that the J-20 design is focused on range and an expanded weapons capability needed to cover the vast Chinese airspace. The J-20 is also slated to carry a variety of advanced electronic systems. This technology includes

an active electronically scanned array, a chin mounted infrared/electro-optic search and track sensor, and a passive electro-optical detection system that will provide 360° spherical coverage around the aircraft. These systems are expected to be comparable to those found inside the F-35. Additionally, the J-20 is likely to field an advanced communications suite that will enable it to datalink with friendly platforms in service and platforms under development.

Analysts noted that the J-20's nose and canopy use a similar stealth shaping design as the F-22 yielding similar signature performance in a mature design at the front, while the aircraft's side and axi-symmetric engine nozzles may expose the aircraft to radar. The J-20 is believed to have first generation level stealth (comparable to F-117's, with a RCS of .269 square feet) characteristics. The F-35 probably has a one-to-two order of magnitude advantage in stealth over the J-20, giving it a first shot/kill advantage in a one-on-one confrontation.

The J-20 also have impressive sensor capabilities. In addition to its AESA radar, the Chinese appear to have copied the stealthy electro-optical targeting system sensor housing from the F-35. The J-20 reportedly also has a 360-degree optical counterpart to the F-35's distributed aperture system. Since the J-20 radar is an early Chinese AESA, it is unlikely to be in the same class as the radar on the F-35. Moreover, it is unlikely China can match the "flying super computer" capabilities of the F-35, including sensor integration and networking to improve pilot situational awareness.

The J-20 Black Eagle is one of two stealth fighters being simultaneously developed in China. The other aircraft is the Shenyang FC-31 Gyrfalcon, a smaller multirole stealth fighter that is being developed by the Shenyang Aircraft Corporation (SAC) and could potentially be commercially exported to other countries. Both Chengdu and Shenyang are subsidiaries of the state-owned Aviation Industry Corporation of China (AVIC). It is likely that the J-20 and J-31 will complement one another when integrated into the PLAAF's service, similar to the US partnership with F-22 and F-35.

J-31/FC-31 Gyrfalcon

The J-31 (FC-31 is the export designation, which is also referred to as the F-60), is one of two fifth-generation fighters being developed in China. Made by the Shenyang Aircraft Corporation (SAC), the J-31 is a twin-engine, mid-size fifth generation export-oriented fighter. There are currently three prototypes, being used as a test-bed. Powered by a pair of RD-93S engines procured from the Russian Federation the first prototype numbered 31001, performed its 10 minutes lasted maiden flight on October 31, 2012. The second prototype, improved version, performed its first flight on December 26, 2016. The new J-31 prototype is three tons heavier and about 20 inches longer than the original technology demonstrator (31001); it also had key improvements like anIRST sensor, stealthier wings, cleaner burning engines, and an improved radar. In addition to avionics and data links that enable sensor fusion, SAC officials state that the production J-31s (which could appear soon as 2019) could have supercruise capability, giving them a leg up over current F-35 fighters. Its RD-93S/WS-13 engines would be replaced by domestic WS-13E or WS-19 turbofan engines to give it that advantage in speed. The combination of the J-31's high speed performance, and suggested payload of 6 PL-12 or 4 PL-21 long range air to air missiles suggests that the J-31 has been optimized as an air superiority fighter, though it can be fitted with a wide array of Chinese precision guided munitions.

The FC-31 is not yet in production, AVIC plans to perform first flight with production model by 2019 and allow J-31 to enter PLAAF service in 2022.

The J-31 made its first public appearance at Zhuhai Airshow on November 12, 2014. The FC-31 is claimed to be the export version, where the J-31 would be the domestic Chinese version of the same fighter. The J-31 is smaller than the J-20. The use of twin-wheel nose landing gear led to speculations that the J-31 may intended to be a carrier-based fighter.



Specifications from AVIC show the J-31/FC-31 has a maximum takeoff weight of 25 metric tons, a combat range of 1,200 km and a top speed of Mach 1.8, or 2,205 kilometers per hour. It can carry 8 metric tons of weapons and has a designed service life of up to 30 years.

The up-to-date scale model of the J-31 that was displayed at the Zhuhai Airshow in 2014 demonstrates several important upgrades from the first prototype (31001), including the installation of an Electro Optical Targeting Sensor (EOTS) pod under the nose, to enable the J-31 to track the heat signatures of enemy aircraft. The new model also has redesigned wings, clipped at the corners to enhance stealth, and all new vertical stabilizers, which have been enhanced for stealth. The new model also has redesigned, stealth optimized engine nozzles, which suggest that a Chinese new turbofan engine at 10- to 11-tonne thrust class will ultimately replace the Russian RD-93S. Notably, such future engines could allow the J-31 to achieve supercruise capability. The J-31 is clearly intended to be a true fifth-generation fighter, not only in stealth but also in sensor fusion and flight avionics.

It is highly likely that the J-31/FC-31 will be China's version of the F-35 Joint Strike Fighter; its development is expected to spiral into both PLAAF and PLANAF variants. The J-31 differs from the F-35 in that it has two engines, which in turn reduces its area ruling, making for more efficient supersonic flight, including future supercruise capability once the J-31 obtains more powerful engines. Like

the F-35, the J-31 has two internal weapons bays that can each carry two medium range missiles, along with two heavy hard-points and one light hard-point on each wing, but while it seems to have added an additional light hard-point to each wing over the capacity of the F-35, it seems to lack the capacity of the F-35 to mount a centerline gunnery or jamming pod.

KF-X/IF-X

As South Korea's second fighter development program following the FA-50, the KF-X Program is led by Korean Aerospace Industries (KAI) and partnered by Indonesia. The KF-X/IF-X Program aims to develop an advanced, fifth generation multi role fighter to meet both Republic of Korea Air Force (RoKAF) and Indonesian Air Force (TNI-AU). Under the 2010 MoU, Indonesian company PT Dirgantara Indonesia (PT DI) participates in the aircraft's development

The KF-X/IF-X is a medium-class, twin-engine, multirole stealth fighter with fifth generation capabilities like stealth, AESA radar, internal weapon bays, supercruise

and sensor fusion. The KF-X/IF-X will have both single and twin-seat versions and to be powered by two General Electric F414 turbofan engines. Compared to KF-16, the KF-X will have a 50% greater combat radius, 34% longer airframe lifespan, better avionics including a domestically produced AESA radar, and better electronic warfare, IRST, and datalink capabilities.

The project was first announced by South Korean President Kim Dae JUNG in March 2001 and South Korea and Indonesia agreed to cooperate in the production of KF-X/IF-X fighters in Seoul on July 15, 2010. On 20 April 2011, South Korea's Defense Acquisition Program Administration (DAPA) confirmed the signing of a definitive agreement between South Korea and Indonesia to jointly develop the Korean KF-X next-generation fighter aircraft. On 2 August 2011, a joint research center was opened in Daejeon. Indonesia is undertaking 20% of development costs and planned to obtain as many as 80 IF-X under the program. While RoKAF plans to obtain 120 examples of KF-X.

On 5 January 2014, DAPA announced the approval of development of the KF-X, performance based on available technologies and in July 2014 the RoKAF and the Ministry of National Defense confirmed that KF-X program would go ahead with the twin-engine C103/KF-X-200 design, technical development of which was completed in 2013. The KF-X-200 twin-engine configuration has been selected over the single-engine KF-X-100 proposal. The RoKAF believes that more than anything else, a twin-engine aircraft has better combat



performance as well as better safety.

Even they are more expensive than the single-engine versions the twin-engine fighters can carry heavier payloads over longer distances. The KF-X/IF-X aircraft is similar in configuration to the F-22, with chined nose and outward-canted fins. Alignment of the leading edges of the wings, root extensions and tailplanes is 40 degrees aft sweep, while trailing edges are aligned 10 degrees forward.

Lockheed Martin, prime contractor of the F-35 Lightning II, won around US\$7 Billion defense deal covering the delivery of 40 F-35As to RoCAF, by promising to provide 25 technologies associated with the F-35 to help KF-X program. And a Letter of Offer and Acceptance was signed under FMS program between South Korea and the US for the purchase of 40 F-35A fighter jets in September 2014. However, in September 2015, DAPA announced that the US has refused to grant export license for four key technologies for the KF-X program; AESA radar, Infra-red Search and Tracking (IRST) System, Electro-Optical Tracking System and next generation radio frequency jammers for indigenous production, delaying the development until at least 2025. There still are worries over whether the United States will transfer the remaining 21 technologies in a timely manner. Meanwhile, the first of 40 F-35As destined for the RoCAF was rolled out on March 28, 2018 at a Lockheed Martin production facility in Fort Worth, Texas. It will arrive in South Korea in 2019.

On December 4, 2015 a Strategic Cooperation Agreement (SCA) on the joint development and production of KF-X/IF-X fighter jets was signed between KAI and PT DI in Jakarta. After the signing ceremony speaking to the media KAI CEO Ha Sung-YONG said that the KF-X/IF-X program would use original South Korean technologies and would not be affected by the US refusal to provide his country with four critical technologies. Meanwhile, PT DI President Director Budi SANTOSO declared that the first prototype would be produced by 2019 and that the fifth prototype would be produced in 2022 at PT DI's facility

in Bandung, Indonesia. "The jet fighter is expected to be operational in 2024 or 2025," he said. Under the strategic cooperation agreement PT DI will send a contingent of some 200 engineers to South Korea for the production preparation stage. PT DI President Director SANTOSO provided following information about the minor differences between the KF-X and IF-X,

"The IF-X will have a greater range as required by the Indonesian Air Force. For air refueling, the IF-X will use a probe system while the KF-X will use a boom system.

The third difference will be the data link. South Korea will use the US-made Link 16 and probably develop their own while we will also develop our own." According to SANTOSO, Indonesia plans to have its own data link to allow communications with the Russian-made Sukhoi Su-27/30 Flankers heavy jet fighters. □

On December 28, 2015 DAPA formally signed an agreement with KAI for the KF-X Program. According to agreement DAPA will finance 60% of the 8.5 trillion won (US\$6.9 Billion) costs required in the development (EMD) Phase, with KAI to pay 20%. Investing US\$1.3 Billion Indonesia/PT DI is paying the remaining 20%. Indonesia will receive one prototype (fifth prototype) and gain access to some technical data and information involved in the project.

In January 2016 Engineering and Manufacturing Development (EMD) Phase of the KF-X/IF-X Program was started. The EMD Phase will cost 8.5 trillion won (US\$6.9 Billion) and will last 10 years and six months. It is planned to be completed during the first half of 2026. As of March 2018, the Preliminary Design Review (PDR) is continuing and planned to be completed in June 2018. The PDR will be followed by Critical Design Review (CDR) Phase in September 2019. After the completion of CDR Phase production of prototypes will commence in late 2019. First KF-X prototype is planned to be rollout in 2022 and expected to achieve maiden flight in mid 2022. Under the EMD Phase six flying KF-X/IF-X prototypes will be manufactured for the test and evaluation purpose. The EMD Phase also includes two

rescue test aircraft, and training and munitions support systems. In a bid to accomplish 65 percent of the localization rates, the domestic industry, academia and institutions will contribute their abilities. Test and evaluation phase will run until 2026 and an entry into service is expected to take place sometime in 2026. It is expected that KF-X/IF-X fighter can get Type Certificate in 2025. Another 9.6 trillion won is earmarked for the serial production of the KF-X fighters, bringing the total budget for the project to 18.1 trillion won (US\$15.7 Billion). The first batch of 40 KF-X aircraft for the RoCAF is expected for 2028. In addition to Korea and Indonesia, Korea will be able to export 600 to 700 units of the KF-X/IF-X, according to KAI.

In May 2016 the General Electric F414-400 turbofan engine has been selected ahead of the EuroJet EJ200 offering for the KF-X/IF-X fighter program. A first-flight is tentatively scheduled for some time in 2020. The engines will be built locally (under license with at least 60% local contribution) under the Hanwha Techwin brand label. In July 2016 Hanwha Techwin signs agreement with GE to locally manufacture F414 engines for KF-X/IF-X fighter jets.

On February 8, 2017 a joint program management office for the KF-X/IF-X fighter program was declared open in Sacheon, South Korea. The office is run by both South Korea and Indonesia. PT DI has dispatched 74 personnel to South Korea for the KF-X program. The number of dispatched PT DI's senior and junior engineers will increase every year that will peak in 2022 where there will be nearly 200 engineers in South Korea.

In May 2017 it was disclosed that DAPA has signed a technology support contract with IAI's ELTA Systems for the airborne testing of KF-X AESA radar and in July 2017 the simplified version of the prototype radar for the KF-X fighter jets was unveiled. To be installed on one of KF-X prototypes the AESA radar will undergo five years of flight tests from 2022 to 2026. Meanwhile, in December 2017 Saab signs a contract for AESA radar development programme in South Korea. Saab will work in cooperation with ADD and its contractual partner LIG Nex1.

TF-X – Turkish Fighter

National Combat Aircraft (Milli Muharip Uçak/MMU) TF-X will be a single-seat, twin-engine next generation fighter (based on FX-1 concept) with stealth features and new generation avionics. Replacing the F-16C/Ds currently in Turkish Air Force (TurAF) service after 2029 the TF-X will be a fifth-generation indigenous air superiority fighter, which will escort and provide air protection to TurAF's F-35A Lighting II fleet. Turkey is likely to procure some 150 TF-X in the long term.

In order to meet TurAF's operational requirements properly, the 60.000lb class TF-X will be equipped with twin turbofan engines, each generating 27,000lb thrust. The first TF-X prototype is expected to achieve its maiden flight in 2023, when Turkey will celebrate 100th anniversary of the founding of the Republic, with either EuroJet EJ200 or F414-GE-400 of GE. First delivery to TurAF is planned for 2029. According to TAI General Manager Temel Kotil, Ph.D when entered in TurAF service the TF-X will have indigenous turbofans each generating 27.000lb thrust. Deliveries will continue until 2039 and TF-X aircraft will be phased out from the Turkish Air Force inventory after 2070s.

The TurAF has initiated National Combat Aircraft (NCA/TF-X) Development Program in accordance with Decision No 545 adopted at Defense Industry Executive Committee (DIEC) dated 15 December 2010. TAI was selected as the Prime Contractor and the Contract for 'Concept Development and Preliminary Design Phase' was signed between the Undersecretariat for Defense Industries (SSM) and TAI on 23 August 2011. Under the



contract, involving a 24-month schedule and came into force on 29 September 2011, between 2011-2013 Prime Contractor TAI prepared three separate conceptual designs with technical support provided by SAAB Aircraft, selected as Technical Support and Assistance Provider (TSAP). These three configurations are named as; FX-1 (configuration with double engine, back wing and conventional tail design such as F-18, Eurofighter, Rafale and Mig-29), FX-5 (configuration with single engine, back wing and conventional tail design) and FX-6 (configuration with single engine, broad delta wing and front wings).

Following the completion of 'Concept Development and Preliminary Design Phase, the Engineering Development & Preliminary Design Phase of the TF-X Program has been launched. Following the lengthy negotiations 48-month scheduled Engineering Development & Preliminary Design Phase Contract was signed between TAI and SSM on August 5, 2016. With this signature the Engineering

and Manufacturing Development (EMD) Phase of the TF-X Program was also started. Under the EMD Phase seven flying TF-X prototypes will be manufactured for the test and evaluation purpose. The EMD Phase will cost US\$8.6 Billion and will last 12 years. Another US\$14 Billion is earmarked for the serial production of the TF-X fighters, bringing the total budget for the project to US\$20 Billion.

Under the Engineering Development & Preliminary Design Phase, which will end up with completion of Preliminary Design Phase, beyond the design and development of TF-X aircraft, engineering capabilities, technology development activities (for key sensors like radar, electronic warfare... etc.), test infrastructures establishment and certification processes will be performed and extensive capabilities for a new generation jet fighter design, development and production will be gained by Turkish Defense & Aerospace Industry. Under the TF-X Program BAE Systems will act



as Foreign Cooperation Partner (Technical Support and Assistance Provider).

On January 28, 2017 in the presence of the Prime Ministers of Turkey and the United Kingdom, BAE Systems and Turkish Aerospace Industries (TAI) signed a US\$156 Million valued Heads of Agreement (HoA) to collaborate under the Engineering Development & Preliminary Design Phase of the TF-X Program. In addition, the Letter of Agreement (LOA) has been signed during the IDEF '17 Fair in Istanbul. UK Department for International Trade brought an Open General Export License (OGEL) into effect on July 28, 2017. The OGEL will allow companies involved in the development of the TF-X Program to apply for licenses to export goods, software and technology from a range of control list classifications, including air launched munitions, fire-control equipment, aircraft components, propulsion systems, ground support equipment, electronic equipment, training and simulation equipment, imaging and countermeasure equipment, and specialized forgings, fittings and coatings. The TAI-BAE Systems Collaboration Agreement was signed and entered in to effect on 25th of August 2017.

As of March 2018, the Engineering Development & Preliminary Design Phase is continuing and planned to be completed in 2021. The Engineering Development & Preliminary Design Phase will cost US\$1.3 Billion and to be followed by the PDR will be followed by 8-year scheduled Critical Design Review (CDR) and Prototype Production and Qualification Phases, which planned to cost around US\$7.3 Billion.

According to TAI General Manger Temel Kotil, Ph.D TF-X will feature Acoustic Heating Technology and during next 10-years period a total of 10,000 Turkish and foreign (including the ones from the BAE Systems) engineers from different disciplines and with supersonic fighter design and manufacture experience (know-how) will work under the program. Under the contract BAE System will provide 400 man/year engineering support for a period of 4 years to TAI under the Engineering Development & Preliminary Design Phase of the TF-X Program.

Turkey's need for TF-X in the long term is anticipated as 100-150 aircraft. TF-X Development Program is carried out under the coordination of TF-X Program Integrated Project Management Office comprising of representatives from TurAF National

Combatant Branch Office, SSM, TAI and BAE Systems personnel. As part of its reorganization effort TAI has established MMU/TF-X Department and Prof. Dr. Mustafa Cavcar was appointed as Head of MMU/TF-X Department.

Basic technical features of TF-X:

Engine Thrust Class	> 2 x 20,000lb
Service Ceiling	> 55,000ft
Max Speed	2 Mach
Combat Radius	> 600nm
MTOW	> 60,000lb
Length	19m (60ft)
Wing Span	12m (39ft)
Wing Area	~ 60m ² (670ft ²)



	Maximum Take-off Weight (MTOW)		Turbofan Engine		
	lb	Kg	Number of Engine	Engine Type	Thrust Level
J-20A Black Eagle J-20B Black Eagle	80.001	36.288	2	AI-31F WS-15	27.600 on 8 prototypes, 5 LRIP 44.000 on Production Models
J-31/FC-31 Gyrfalcon	61.729	28.000	2	RD-93 WS-13E	19.000 on 3 Prototypes 22.500 on Production Model
MMU / FX-1	60.000 70.000	27.215 31.751	2	N/A	22.000 on 7 Prototypes 27.000 on Production Model
KF-X/IF-X	53.000	31.751	2	F414-GE-400 F414-GE-400-EE	22.000 on 6 Prototypes 26.400 on Block III Version
F-35A Lightning II	70.000	31.751	1	F135-PW-100	43.000
F-22A Raptor	83.500	38.000	2	F119- FW-1000	35.000
Su-57/T-50 PAK FA	81.571	37.000	2	AL-41F1 Izdelye-30	33.000 on Prototypes & LRIP 39.566 on Production Model



Turkey's Aeronautic Prestige to Economic Opportunity – THK's 2020 World Air Games will have All Eyes in the Skies and Visitors Exploring the Wonders of Turkey

THK's reputation has been 100 years in the making. Participation of least 75 countries are expected in the 5th World Air Games in Turkey with 12 branches in 5 cities significant contributions are expected to benefit tourism and the promotion of the country. In this exclusive Defence Turkey interview, Turkish Aeronautical Association's President Mr. Kürşat Atılgan discusses the various activities and programs of the THK and the diligence, talent and national devotion that are a source of national pride

Defence Turkey: Mr. Kürşat Atılgan first thank you for your time for this interview. Could you briefly inform us about the activities, duties and responsibilities of the Turkish Aeronautical Association (THK)?

It is necessary to take a brief look at the history of the Turkish Aeronautical Association (THK) in order to explain its fields of activity and its duties and responsibilities. THK's responsibility is within the National Spirit and National Consciousness that exist in our State. For this reason, our Institution was born on February 16, 1925, 16 months after the proclamation of the Republic, on the orders of the Great Leader Mustafa Kemal Atatürk himself.

The Turkish Aeronautical Association has developed a vision and strategy to carry Turkish aeronautics winged with the aim of "The Future is in the Skies" to carry forward scientific, technical, sportive and commercial aspects, and today it has become a structure that is not unique in the world. THK is active in every field in order to bring the Turkish aviation above the level of contemporaneous civilizations, closely related to today and tomorrow of aviation, researching and developing. On April 23, 1926, it established the "Airplane Machinist School" for the purpose of establishing the technical staff of Turkish Aviation. In the same year, we built "Kayseri Aircraft Factory" again. Thus, in 1926, THK had an organization that manufactured the airplane, trained technicians, and trained pilots flying them.

The point that should not be overlooked here is that the Turkish Aeronautical Association has given life to such an institution by allocating resources for a nation that has emerged from a tough struggle like the War of Independence and is starving toughness. In the following 10 years, Turkish Aeronautical Society donated 351 airplanes to the Turkish Armed Forces, which they produced or procured.

Sportive aviation is at the heart of the aviation industry. All of the basic inventions of aviation have been thanks to amateur sport aviation. In those years, THK set up a very serious vision in the field of sport



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as well as industrial and technical activities, and 4 years after it was founded, it became a member of the International Aeronautical Federation (FAI, the sole international body for sporting aviation). We have been representing our country successfully in air sports branches all over the world since that day.

Nowadays, THK is resolutely continuing to create a Turkish Youth with THK Aerospace University (UTAA) which started teaching in 2011, that is training a generation whose target is space, to meet the majority of the pilot needs of our country, to have a wide range of technical maintenance skills with its affiliates, to provide health services through helicopters and ambulance helicopters, to organize training, demonstration, national and international competitions in all branches of Sportive Aviation, to walk to future with the nation arm in arm with almost 400 Turkish Aeronautical Association Branches scattered throughout Turkey, to fly with all free trainings given to young people

in Aviation and Training Centers in Ankara-Etimesgut, Eskişehir-İnönü, İzmir-Selçuk, Antalya-Karain ve Erzincan.

Defence Turkey: What are your responsibilities and duties in terms of delivering training and certification of athletes of sportive aviation branches such as free parachute, gliding, paragliding, sailing wing, model airplanes as the only authorized authority in the country by World Air Sports Federation (FAI) which you have been a member of since 1929?

THK is the only institution that holds the responsibility of Aviation Federation and is officially recognized by FAI which has 110 member countries as the only official NAC (National Air Sport Control) institution of the country. This state has been expressed in the THK code that is approved by the Decree of the Council of Ministers. As a requirement of its founding purpose, THK, bears the liability of "Turkey's Air Sports Federation" as stated in the decision of Council of Ministers.



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Only one NAC is recognized by the FAI as the official representative in each country. Therefore, THK, carries the authority to organize national and international championships, to determine the national team athletes to be sent to the First Category contests such as World and European Championships, capable of providing FAI license to deserving athletes who want to participate in other official international competitions and is the only official body authorized to register the ratings and records obtained in the official organizations organized in Turkey. As a requirement of this situation, every year we organize national and international championships and competitions in all branches of sport aviation in accordance with the FAI agenda.

Our goal is to train athletes worthy to represent Turkey and to maintain and raise the reputation of Turkey in the World Air Sports Federation which has been long existing and already deserved. As you know, THK organized World Air Games for the first time in FAI history in Turkey in 1997. After these games, air sports have entered another era in our country as well as in the world.

Defence Turkey: When you consider international standards, how do you evaluate the global scale position of Turkish Sport Aviation with regard to its pros and cons?

First of all, it is necessary to specify that THK is a structure that has been subject to an unprecedented nation support and admiration and has achieved firsts in all areas of aviation. When we look from a sportive perspective, world countries usually stand out by individual formations or just with a sporting branch or discipline. For example, in a country, a certain group of people come together with the purpose of a hobby and carry on a branch that they may like through their own means or through sponsors. However, under the roof of THK without exception all branches and disciplines of Sports Aviation in Turkey are carried out. There is an academy for every branch within our organization. What I say is not an easy task because aviation is a tiring and expensive business. Therefore, it is not possible to sustain a Flying Turkish Youth goal without effort and financial support.



Mr. Kürşat Atılğan - THK President met with Mr. Cem Akalın - Managing Editor of Defence Turkey Magazine at THK premises in Ankara

Thankfully, THK is able to offer air sports which are expensive and demanding to our youth with the material and spiritual support of the supreme Turkish Nation. Every year about 7000 athletes are trained at THK Aviation Training Centers. This number reaches up to 70.000 per year together with the athletic branches and clubs of the schools affiliated to the Ministry of National Education, Public Education Centers, and the athletes raised by THK in the regional courses opened in various regions of our country. The number of countries that can approach this number on a global scale is very few. There has been a partial reduction in the number of competitors and athletes due to some of the negativities experienced in the recent years. With the measures we have taken and will take, we have gone through restructuring process and we will train top level athletes in the upcoming period.

Our goal for the 5th World Air Games, which will take place in our country in 2020, is to receive medals with the Turkish athletes from every branch.

Defence Turkey: You are getting ready to perform World Air Sports again in Turkey in 2020 that you first performed in 1997. Certainly it was not easy to make the re-organization of such a large performing in Turkey after twenty three years. Could you briefly evaluate this process and the preparations made? As a country with significant competence in this field, what would you like to say about the added value of this organization that will benefit the country's economy?

World Air Sports were awarded to Turkey in a very difficult period. Bringing it to Turkey, especially the period in which western world made unfair accusations and propaganda against Turkey, is great importance to Turkey. The idea of bringing this huge



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activity to Turkey emerged in 2016. As Turkish Aeronautical Association in 2017, we took a serious struggle with a smart strategy. At the end of the process, the United States, Malaysia and Turkey remained in the short list. With the infrastructure capabilities of THK and using the advantages that our country's facilities and geography have provided us, we have entered into an aggressive struggle. In the end Malaysia was in our favour. We faced the US. Finally, it was given to Turkey with the support and consensus of World Aeronautical Federation (FAI) organization's board's vote. THK's brilliant and personable performances in this nearly 100-year history, the first performance of the World Air Sports in Turkey in 1997 by THK have affected to FAI that rightful prestige of THK on FAI.

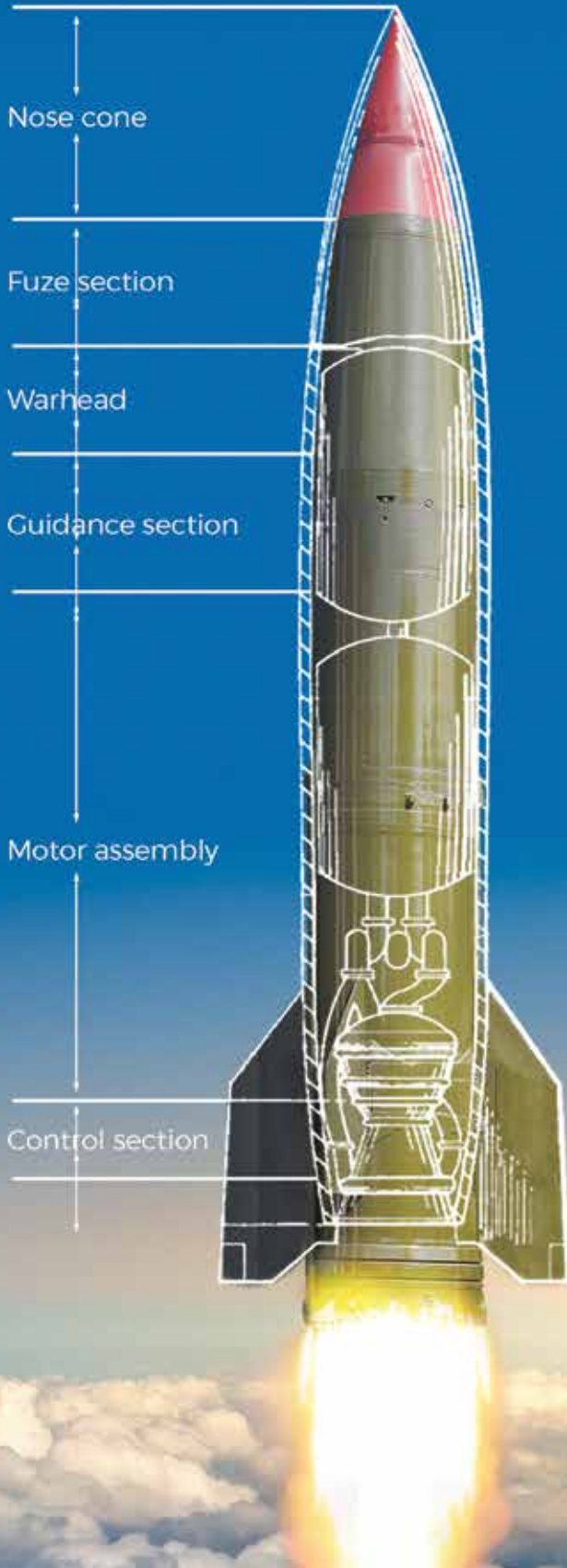
There are 110 active member states within the FAI, where THK has been a member since 1929. Our expectation is that at least 75 countries will join the 5th World Air Sports. We will organize air sports in 12 branches in 5 cities. One of our definite places is İnönü education camp in Eskişehir. We are planning a model airplane contest in and opening ceremony of games in Ankara. General aviation acrobatics in Antalya and parachute organization in Izmir are being planned. The location of the balloon is not clear yet, and it will be decided together with FAI.

Many countries want to get such big organizations to contribute their tourism promotion. The activity will contribute to the Turkish tourism and the promotion of the country in the amount of one hundred million dollars annually.

We will perform the fifth of the World Air Sports. At the 1997 World Air Sports, balloon and paragliding tourism was at the forefront. Today, these two branches bring annual turnover of \$150 million to the Turkish economy. After 2020, we will see that these figures are much larger than this, I hope. In the games to be performed in 2020, drone races will be in the forefront. Drone is a fast-developing field with a variety of purposes and potential for use in various fields. As a natural result of this, it has a feature that can create its own economic market. We are on the verge of future investments and agreements in this regard. We are also developing our plans in this direction.

Air sports will bring vitality to our tourism for the next 3 years. Test competitions, preparatory steps, international meetings that technical staff will be attended take three years. These three years, the heart of the world's sporty aviation will be in our country. We are expecting almost to 4.000 athletes and coaches because of air games. There will also be air sports enthusiasts from around the world to watch the contests. In this way, they will experience the wonderful atmosphere of our beautiful country. With the advertisements through media, we will show the efforts made by foreign power groups to create negative perception about the tourism of Turkey does not reflect the reality at all. Therefore, the value that the 2020 World Air Sports has created directly and indirectly will really reach very large numbers.





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Defence Turkey: What kind of works have you been doing on increasing the country and sports participation in the 2020 World Air Games? Can you briefly inform us about the preparations made in this context and the investments and works planned in this two-year period?

First of all, it should be noted that the World Air Games to be performed in 2020 will not be an Air Show, it will be a World Air Games in Olympic format.

Competitions will be organized in all disciplines of all branches mentioned in FIA's sports code document within the scope of this event. As I said, we expect more than 3000 athletes from at least 75 countries. Considering coach, referee, delegation, assistant, kinsmen of athletes and administrators, it can be said that the number will exceed tens of thousands with the fans of Air Sports who will come to watch the games in Turkey, and the heart of air sports will beat in Turkey from 2018 onward.

Our plans on sending more athletes to the national and international games organized in training centers and in Turkey, and to the events on abroad are ready for developing our athlete background and increasing our athletes' international experiences. In this way, we aim to increase both the athletes' scores in international rank and our country score.

Defence Turkey: We see that a significant proportion of the personnel working in civil aviation organizations active in Turkey starts aviation with one of sport branches of the Turkish Aeronautical Association. When we look at the rooted history of our institution, many names that are the pioneers in Turkish aviation history such as Vecihi Hürkuş and Sabiha Gökçen come into prominence. What additional responsibilities does it take for you to be in such a crucial position in Turkish Civil Aviation?

The responsibility of having a deep -rooted history and being pioneer in Turkish civil aviation is of course great. However, being one of the national institutions of Turkish Republic, the institution of its nation, and its historical duty imposed by the Republic and the nation should be



assessed as an actual and greater responsibility.

For this reason training in all aspects of sportive aviation is not enough to fulfill this responsibility. It needs to be understood the quote " The future is in the skies " There are a number of aviation and aerospace colleges in the world. One of these is University of THK (UTAA). It is not enough to train only in certain branches here. In addition to supplying human resources to Turkish Civil Aviation, our main responsibility is to undertake research, development and to reach and surpass the countries in the level of modern civilization and to establish Turkish National Aviation with all its elements. When we accomplish this task, we can have the future in the sky. Moreover, this goal will keep its reality as the Earth exists. We direct UTAA, still very young, to this goal as the only specialized university in our country. In addition to UTAA, the investments to be made about the nationality of all the elements of National Aviation

Glider - İnönü Training Center, Eskişehir are major investments. Construction of national strategies and directing national policies towards the aim as well as the material and moral support of noble Turkish nation are important. THK continues to work with its nearly one hundred years of experience, equipment, awareness of its responsibility to give the biggest contribution to Turkish Aviation in the future like in the past and the determination to fulfill this responsibility in the best way.

Defence Turkey: You are the only representative of International Air Cadet Exchange Agency (IACEA). What would you like to say about this program?

International Air Cadet Exchange Agency (IACEA) was established in early 1950s and THK has been an active member of IACEA since 1953.

The IACE program involves mutual visits to countries by aviation youth for fifteen days a year, aimed at bringing together aviation entrepreneurs of the countries, transferring aviation experiences and passions to each



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other, and social and cultural aspects of different countries of aviation youth. The program includes both sightseeing and exploration of aviation facilities as well as social and cultural excursions.

We have "Young Wings" community who are members of THK. Today we have more than 10 thousand young wings in the 16-21 age group registered to the THK Branches. Every year, some young wings are selected by considering the amount of aeronautical activities among others, their academic success, their success in the English examinations, and their work in the THK branches, and are being paid by THK for the expenses of the mutually agreed upon countries for fifteen days. This year, we will send 11 students to Germany, England, Hong Kong and China. The program will be implemented in July. We will also host students from the same countries. We will make these students watch our activities at Aviation Training Centres, and provide them with the opportunities of fly gliders, paragliders, sail wings, jump parachutes at the drop zone in Ephesus. In addition, we organize cultural tours that include historical, touristic and social activities in Istanbul, Ankara and Izmir.

Defence Turkey: Eurasia Air Show will be held for the first time this year in Antalya between April 25-29. In this organization, where the final preparations are made, many domestic and international aviation companies will exhibit aircraft on both the static field and flight displays. As Turkish Aeronautical Association, you are one of the institutions that support this organization. In this context, which activities of the



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Turkish Aeronautical Association will visitors have the opportunity to examine closely? Will your activities and demonstrations be planned specifically for the organization? Would you also be able to inform us about your support for this organization?

It is understood from the preparations that Eurasia Air Show which will be realized for the first time this year will present us a very successful organization on behalf of Turkish Aviation. Being invited to the organization made us happy on behalf of THK which is the basic building stone of Turkish Aviation. We also invited the FAI President and guests to the Air Show. We will set up a stand to promote 2020 World Air Games. As an institution we will be at the Euroasia Air Show in a wide spectrum. Hot Air Balloon, Glider, Microlight, Gyrocopter, THK Flight Academy's planes, Ultralights, Powered Paragliding, Sailing wing and 1 CL-215 fire plane will be in the

scope of the show. It is possible to perform and view the fire extinguishing exercise in case the Flight of Hot Air Balloon is flying bound to the ground and the operation is available. Our fire plane will be waiting for the station to perform its primary mission in the relative position. One of our C-208 aircraft will be under the control of the Organizing Committee, which will be allocated for aerial photographing on all flights of aircraft participating in the Air Show. We also wanted to add color to the airshow with other air vehicles and parachute jumps. However, we will not be able to perform these demonstration activities due to the scheduled flights to the known Antalya square and due to the high attendance expectation. It is our duty to be present as THK everywhere where there is aviation, and we are delighted with this.

Defence Turkey: Sayın Atilgan, lastly, would you like to give a message to the readers of Defence Turkey Magazine?

I think it is very important for our country to make international and very big organizations such as World Air Games because of the sensitive situation in our country. I consider this activity a very important opportunity to introduce the suitable geography for Turkey's tourism potential and actual air sports to the world. The fact that World Air Games, one of the world's largest and most prestigious organizations after the Olympics, will be held in 2020 in Turkey is very convenient in terms of timing. I have full faith that the 2020 World Air Games will have a high opportunity with added value along with the never-ending support of our nation and our government agencies' dedication to THK ■



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Aselsan - Turkey's Avionics Leader

The flight management, navigation, electro-optical, communication, radar, electronic warfare, weapon and mission systems designed and manufactured by Aselsan have been fielded and used by the Turkish Armed Forces for many years

Aselsan, Turkey's leading defense company, has been successfully performing its activities over 40 years for development and production of the most critical avionics systems used in helicopters, fixed wing aircraft and unmanned aerial vehicles, as well as the integration of such systems to air platforms for both national and international customers. Beginning its activities in the area of avionics with the production of navigation systems of F-16 fighter aircraft in 1988, Aselsan is now one of the best-known avionics equipment manufacturers in the world with 1200 experienced personnel in the field of aviation and now transferring its experience into civil avionics area as well.

The modernization of more than 500 air platforms over 20 different types is totally accomplished by Aselsan engineers with its own know-how and capabilities. Aselsan also integrates all types of weapon systems including national munitions to air platforms through indigenously designed mission computers.

Effective and Reliable Mission Systems

The Turkish Armed Forces have increased operational capability and minimized its foreign dependency by use of Aselsan's indigenously developed high-tech systems on many air platforms such as T129 "Atak" Helicopters, F-16 Fighter Aircraft, S-70 Black Hawk Helicopters, "Hürkuş" and "Anka" platforms.

In the T129 "Atak" helicopters, which is our country's pride, national capabilities were used at the highest level. All avionics systems in the helicopter are designed and manufactured by Aselsan. Aselsan also performed the integration of all weapon systems of T129 "Atak"




Helicopters, which are now in service of Turkish Land Forces. AVCI Helmet Integrated Cueing System, specifically developed for T129 "Atak" Helicopter, is the world's first Helmet Mounted Display having both optical and inertial hybrid head tracking system. With its high-performance tracking capability, the helicopter's electro-optical targeting and weapon systems are automatically slaved to the pilot's line of sight.

Turkish Army's operational capability is improved with the use of ASELPOD Targeting Pod and Laser Guidance Kits (LGK). ASELPOD is specifically designed for modern fighter aircraft such as F-16s with day/night vision and laser designating capabilities.

Aselsan Systems on All Over the World

Thanks to the know-how gained from T129 "Atak"





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Helicopter, long-term strategic cooperation agreement was signed with Sikorsky for national and international sales. Within the scope of this agreement, “Integrated Modular Avionics System (IMAS)” responsible for the management of all systems on the helicopter is being developed by Aselsan.

IMAS will be used not only in 109 helicopters that Turkey is purchasing, but also it will be used in at least 164 helicopters which will be sold to third countries by Sikorsky. The high-tech systems developed and produced by Aselsan are included in the standard avionics configuration of Black Hawk helicopters, which is used by

many countries all over the world. Thanks to the Turkish General Utility Helicopter Program, a new generation utility helicopter with one of the most modern avionic architectures in the world will be in the service of Turkish Armed Forces and the avionics systems designed by Aselsan engineers will serve pilots and users all over the world.

Within the scope of the cooperation agreement between Aselsan and ANTONOV, one of the world’s leading aircraft manufacturer, Aselsan’s avionics systems and mission equipment will be used on the AN-148 family aircraft, which can be configured to perform different missions such as cargo aircraft, general



purpose aircraft and regional passenger jet.

Innovative Solutions for National Platforms

As part of the T625 Turkish Indigenous Light Utility Helicopter Development Program, the avionics systems, primarily basic cockpit equipment, are being developed by Aselsan. Within the scope of this program, Aselsan performed the innovative cockpit design that could compete in global helicopter avionics market. The next-generation smart cockpit consists of large area smart displays in order to reduce the pilot’s workload and maximize flight safety.



Indigenous Turkish Fighter (TF-X) platform will also have next-generation smart cockpit. The smart cockpit will include advanced features such as 3D audio, synthetic vision and automatic speech recognition. Aselsan with its huge experience and know-how, is ready for the development of mission systems, sensors and avionics systems for TF-X Program which has an important place amongst the ambitious 2023 visions of our country.

Aselsan, the flagship of the Turkish defense industry, continues to be at the forefront in Turkey’s technological independence efforts.



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Critical Industrial Sectors in Turkey Harness Industrial Internet of Things Fueling Growth with Honeywell's Connected Technologies

In this exclusive Defence Turkey interview, Mr. Orhan Geniş, President of Turkey & Central Asia at Honeywell discusses Turkey's commitment to industrial innovation and growth, and partnership with the biggest names across industry, extending their search to SMEs for potential competitive opportunities to work with local businesses

Defence Turkey: Dear Mr. Orhan Geniş, first of all thank you very much for the interview. Could you please inform us about Honeywell Turkey's office, its structure and activities?

Honeywell opened its first Turkish office in Istanbul in 1992, with a staff of 10 people. It was the start of what was to become a successful 25 year growth story for the company that today has more than 300 people across three offices in Istanbul, Ankara and Izmir. Today all of Honeywell strategic business units are active in Turkey; which are Aerospace, Honeywell Building Technologies, Performance Materials and Technologies, and Safety and Productivity Solutions.

Honeywell continues to experience high growth in Turkey, driven by growing demand for technology designed to maximize the performance and efficiency of industrial processes. We have extensive operations in Georgia, Azerbaijan, Turkmenistan, Uzbekistan and Kyrgyzstan. Istanbul is our headquarters for the Central Asia region and Central Asian countries come under my direct responsibility. These countries are all experiencing rapid urbanization, a significant rise in their middle-class populations, growing demand for energy and resources, and are making huge investments in infrastructure.

Defence Turkey: What are Honeywell's core capabilities, technologies and which products are focused on aerospace and defense?

Honeywell has a long legacy in the aerospace and defense sectors. As a result we have a number of key capabilities and advanced technologies in this realm. Currently we are focused on connectivity.

Connectivity in the battlefield creates a landscape of consistent and interconnected communication regardless of the type of platform or its location. With connected technology, an unmanned aerial vehicle can pass real-time data to ground forces and an aircraft can share tactical information with a tank. Our JetWave hardware, powered by Inmarsat's Global Xpress Government Services network, allows for a variety of mission communication applications, including secure in-flight video

conferencing, real-time weather data, and large file transfer and information exchange between platforms on the ground and in the air.

Additionally, Honeywell has a suite of connectivity products that cater to defense helicopter operators to help them stay connected in flight, and offers predictive system information to keep them aware of potential maintenance issues and faults before they become an issue. Most recently, Honeywell introduced the Aspire 150 and 350 satellite communications systems. These systems reduce the impact of rotor blade interference and provide helicopter operators with high-quality connectivity.

Defence Turkey: Mr. Geniş, Honeywell successfully completed its 25th year in Turkey. We know that Honeywell considers Turkey to be one of the emerging and growing industry markets. In this context, what would you like to say regarding Honeywell's current position in Turkey's industrial development from energy to health, transportation and defense industries, as well as the new opportunities and technologies to strengthen this cooperation in the upcoming period?

Turkey is an important market for Honeywell – it is the bridge between Europe and Central Asia and one of the company's "High Growth Regions" (HGRs). Our technologies are used in several of Turkey's 'smart' oil and gas refineries, making them safer, smarter and more efficient. We support the country's military aircraft fleets to improve mission performance and asset uptime and availability.

Honeywell plays a crucial role in many of Turkey's large industrial programs – from airports to high-rise buildings and rail infrastructure. Most importantly Honeywell is a proven local partner for Turkey, helping it meet its indigenous industrial growth objectives. We will continue to support Turkish industry, as has been the case for the last quarter century. In the future, we will deliver even more "Connected" technologies across Turkey's most critical industrial sectors to ensure the country establishes itself for growth fueled by Industry 4.0 and the Industrial Internet of Things.

Defence Turkey: Honeywell has over 23,000 engineers throughout the world, 11,000 of which are software developers. It is also expected that 60 percent of the company's growth in the next five years will come from branches related to software. These are comprised of mobile applications, cloud-based software, cyber security as well as Industrial Internet of Things (IIoT) solutions that connect a vast number of hardware systems. Within this frame, how do you envisage adoption and development in the Turkish market in the upcoming period where Industry 4.0 becomes more widespread? How does Honeywell provide solutions to companies and institutions in this field?

Honeywell is an established technology partner across many of Turkey's most important growth industries, yet the potential for further growth, partnerships, innovation and investment in Turkey remains greater than ever. The reason for this is our rapidly developing focus on software, and the significant need of Turkey's technology sector to capitalize on a new era of industrial innovation – Industry 4.0.

The first such industrial revolution occurred in the late 1800s, as the use of water and steam power to automate manual tasks became mainstream. This was followed in the 1920s by the second industrial revolution, which saw the use of electricity to enable mass production. The 1970s heralded the arrival of the third industrial revolution – the dawn of the microchip. In this new computer-driven area, industrial companies were able to automate production and data processing for the first time and, in doing so could make their operations more productive and efficient.

Industry 4.0 reflects an evolution of the computer era, combining robotics, data analytics, and artificial intelligence to blend the physical environment with the digital world. This is possible thanks to significant advances in computing power, increasingly high speed physical and wireless datalinks, and new capabilities in software. One of the main tenets of Industry 4.0, and the lynchpin of Honeywell's modern



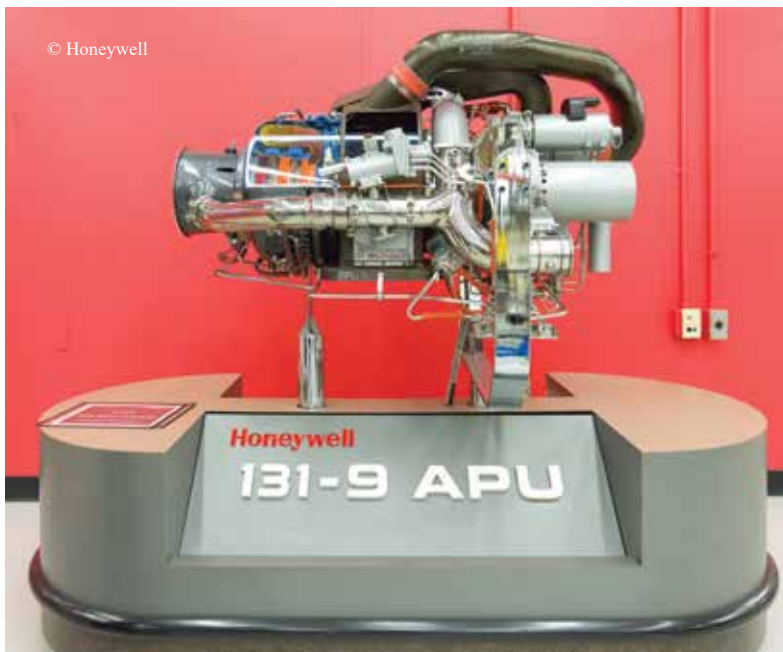
portfolio, is the Industrial Internet of Things (IIoT). IIoT refers to the ability to achieve greater visibility of, and value from, operations by connecting the large number of hardware systems, or 'endpoints', that exist within typical industrial operations.

The vast quantity of data these endpoints generate every minute is aggregated, and stored and analyzed either locally or remotely from anywhere in the world. By harnessing data in this way, IIoT enables industrial companies to unlock intelligence, or value, from their data, helping them lower costs, improve productivity, efficiency, security, and safety, and best position their operations for growth.

Honeywell's technology portfolio aligns to Industry 4.0. We provide

the endpoints that manage, improve and collect data across an industrial operation. We provide the security systems that protect this data from cyber threats, and we also provide the hardware and software-based aggregation tools that interface with hardware and harness the data they generate. This is very valuable to our customers.

Honeywell's portfolio, long-standing local partnerships and sector knowledge, as well as our pioneering work in helping companies harness IIoT, combined with Turkey's commitment to industrial innovation and growth, affords us a positive outlook for our next 25 years. In partnership with the biggest names across industry, we are committed to driving the adoption of IIoT



Honeywell 131-9 Auxiliary Power Unit

across Turkey and look forward to helping many ambitious, fast-growth companies benefit from Industry 4.0.

Defence Turkey: Honeywell is an important solution partner of Turkey in terms of software and hardware support in civil and military aviation. Could you please clarify for us the existing commercial airline clients as well as the scope of these collaborations?

Today Honeywell is working in close cooperation with more than 30 commercial operators and MROs in Turkey. The scope of this cooperation varies from parts, software and service supply to Worldwide Channel Partnership, such as in the case of Turkish Airlines Technics.

Defence Turkey: You have been offering your customers cockpit software and hardware solutions such as the Ka band JetWave high speed satellite communication system, 3D weather radar, traffic and collision avoidance system (TCAS), smart runway & landing system and ground proximity warning system; as well as engines and propulsion systems for fixed and propeller wing military and commercial aircraft platforms; and services and technologies such as maintenance, repair and upgrade services for commercial and military aircrafts in order to minimize malfunction time and to ensure that fleets continue to run smoothly. Can you touch on the requests from Turkey for your products and services in this context?

Honeywell Aerospace technologies, products and services are found on virtually every commercial, defense and space aircraft around the world. Honeywell develops innovative solutions for more efficient aircraft; more direct, on-time flights and safer flights, as well as more controllable runway traffic. Alongside this our legacy in manufacturing aircraft engines, cockpit and cabin electronics, wireless connectivity services, avionics, and more shows our significant commitment to and expertise in the sector. As a specific example, all new generation Airbus NEO and Boeing MAX series aircraft ordered and operated by Turkish operators will be flying with Honeywell Auxiliary Power Units, showing the confidence Turkey has in Honeywell technologies.

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Defence Turkey: Honeywell is also allocating significant resources in SATCOM technology with the “Power of Connected” motto. You are also providing a distinctive service to end users by engines, Auxiliary Power Units (APU) or weather radar raw data collected via Honeywell solutions; afterwards this raw data is processed and can be transformed into essential data for the service supplier to reduce costs etc. What would you like to say about these services that can provide flexibility to both commercial airlines and military fleets in life cycle management and cost? What type of requirements are you seeing for the procurement of such technologies and services in Turkey, as a market that is booming with each passing day in the aviation industry? Could you please discuss the current status and share your future expectations with us?

Connectivity and Connected Aircraft are revolutionizing the aerospace industry. In two years, Aircraft connected through Honeywell products will manage over 150 TBs of data a day, which is equivalent to 300,000 movies. By 2025, around 25,000 aircraft will have Wi-Fi on-board.

Connectivity, which is already transforming the world we live in at a fundamental level, creates a revolutionary opportunity to transform the aerospace industry. The incredible amount of data generated in-flight is changing the way an airplane operates, from takeoff and landing to maintenance, making it smarter and more efficient. This revolution brings the opportunity to increase an aircraft's flight efficiency, productivity, and availability as well as reduce its operating cost, while delivering a more comfortable, enjoyable, and safer experience for passengers.

Connected Maintenance solutions help keep an airlines operations on song – improving on time performance and reducing delays.

Honeywell is uniquely placed to leverage our extensive product portfolio and expertise in aircraft systems to understand and deliver a connected maintenance solution. By wirelessly connecting more mechanical systems, we are able to



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JetWave High-Speed Satellite Communication Hardware

drive improved predictive analysis. This allows ground crews to identify components that will require maintenance or replacement before the aircraft lands – and ensure spare parts are available, if needed, ready for installation when required.

For example, capturing and analyzing aircraft data on usage and wear enables Auxiliary Power Units, Wheels and Brakes to be more efficiently inspected, undergo more rapid and streamlined maintenance processes, contributing to lower costs.

Turkey and Turkish operators are well-positioned in this game-changing technology to improve the operational efficiency, productivity and availability with an ultimate target of reduction in operational costs, all while achieving increased in-flight comfort and safety to enhance passenger experience.

Defence Turkey: Mr. Geniş, regarding aftermarket, you had aspired to specifically collaborate directly with the end user in military platforms and systems. This was not actualized due to the FMS and G2G implementations

in the previous period. With the corporatization of military factories, how do you anticipate growth in Turkey in this particular field? What would you like to say about the advantages of working directly with the end users?

Corporatization means profit oriented thinking. Our value is improving both performance & efficiency. This will help us to grow in the market given that our aim is to share value that we generate with our customers.

Defence Turkey: In the Turkish market, we see that you have adopted a growth oriented approach with strategic partnerships rather than a direct sales-oriented approach. Within this frame, how do you cooperate with companies, and which companies are you partnering with in the defense industry?

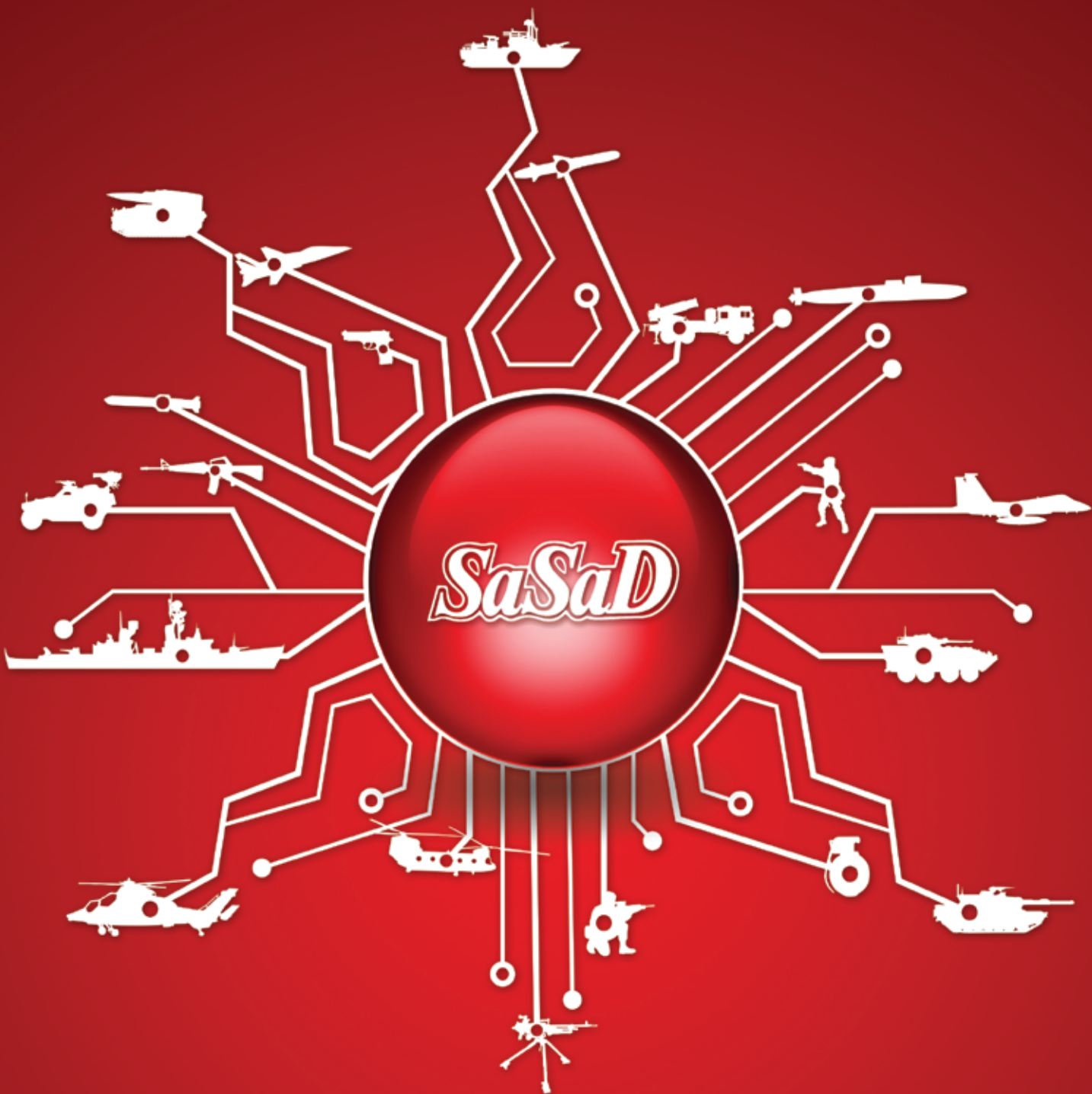
We are continuously seeking further opportunities to work with Turkish companies to further develop our extensive avionics and mechanical portfolio.

Defence Turkey: The joint production of Rolls-Royce's and



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Honeywell - Boeing 757 Test Aircraft



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Honeywell's LHTEC CTS800-4A engine was successfully performed and has been proven over the T129 platform. The procurement of T129 "Atak" helicopters, which will be delivered to the Land Forces Command according to the program schedule, are going on swiftly. Apart from this package, negotiations with the Naval Forces Command and the Gendarmerie General Command for the procurement of these platforms and engines were conducted. How is the export license approval process proceeding following the negotiations made with both commands and after the contract award with the Ministry of Interior?

We haven't faced any export license related problems.

Defence Turkey: With the T625 Multi-Role Helicopter program, you are executing a very successful collaboration model with TAI. A contract was signed between the parties to purchase up to 10 engines in the development process, and part of these engines were already delivered according to the project schedule. Could you please inform us on the latest status of the program?

This year is critical for the program because ground tests and flight test will be performed. From our contractual point of view, more than 50% of our work has been completed. Three engines have been delivered with three more to come this quarter.

Defence Turkey: Mr. Geniş, we know that you have a long-term plan that incorporates different phases of industrialization of the aforementioned engines and the production of these engines with the local partners in Turkey. In order to attain affordable costs to be competitive in the production phases, the main contractors, SMEs and the subsidiary industry should be actively involved in this program. Especially for the engine to be non-ITAR, a robust eco system has to be established at the component levels as well. What kind of a model do you offer solution partners in this regard?

We initially discussed only well-established and recognized local players for the part manufacturing. But have now extended our search to SMEs and we will conclude this

initiative by the end of the year. If the SMEs are competitive there are potential opportunities for us to work with these local businesses.

Defence Turkey: Under the leadership of the Undersecretariat for Defense Industries, crucial programs have been initiated recently, namely the Atak-2 (upgraded version of T129 Atak) and the 10-ton class unique General Utility Helicopter programs. This decision was publically declared last December. Within the context of this official statement, the Undersecretary for Defense Industries Prof. İsmail Demir also conveyed a significant message to international partners who are willing to be involved in this program and he said: "If you aspire to this program our door is open for this collaboration." For Honeywell, that assumes significant responsibilities in the T129 "Atak" and T625 Multi-Role programs, how do you approach involvement in these unique national programs? Could you please share your assessments?

Each new platform development brings us a range of opportunities. When the platform size increases and our incumbent solutions are no longer suitable we have a variety of solutions to consider for these larger platforms.

Defence Turkey: What are your growth predictions for the Turkish market in the next five-years?

Turkey is one of the high growth countries and the Turkish economy surged 7.4 percent last year, marking its fastest expansion in four years with robust growth in industry, services and construction. In parallel to GDP growth, we anticipate strong growth in the Aerospace market supported by both pillars, civil air transport and defense industries.

Defence Turkey: Mr. Geniş, Honeywell has been involved in signature social responsibility projects in Turkey over the years. In this context, could you please inform us about your studies with academies and your social responsibility projects?

Honeywell takes its commitment to Corporate Citizenship, protection of the environment, and creation of Sustainable Opportunity everywhere

it operates. We have a serious and committed approach to responsible business practices and in making a measurable difference across the neighborhoods and communities in which we operate. The Honeywell Hometown Solutions (HHS) initiative combines focused leadership, financial support, and volunteerism to address local neighborhood needs where Honeywell can make a lasting impact. All HHS activities are aligned to at least one of five core pillars – Science and Math Education, Housing and Shelter, Family Safety and Security, Habitat and Conservation and Humanitarian Relief.

We have an ongoing relationship with METU, the Middle Eastern Technical University, based in Ankara, which has provided technical equipment and industrial automation platforms to assist in the training of engineering students. Every year Turkish students and teachers attend the USA's Space & Rocket Center in Alabama as part of the Honeywell Leadership Challenge Academy (HLCA) and Honeywell Educators @ Space Academy (HESA) programs. These have been created to inspire education and careers in the fields of science, technology, engineering and mathematics.

Defence Turkey: Lastly, would you like to convey a message to the readers of Defence Turkey?

Honeywell has a unique proposition based on three main elements. First, we have a vast and practically unrivalled domain knowledge spanning thousands of customers in a large number of industrial sectors, and a 125-year heritage on which to build.

Secondly, we have the hardware, which includes the end points and control systems that customers use to manage their operations. Additionally, we have the software systems and data that we are able to aggregate, analyze and extract value from. Of our 23,000 engineers more than half are focused on software development and an estimated 60 percent of our growth over the next five years is expected to be connected to software. This proposition lets companies across virtually any industry harness IIoT within their operation in a way that is safe, secure and trustworthy ■

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Roketsan to Display Unique Products at Eurasia Air Show

Turkish Leading Manufacturer in Ammunition, Rockets and Missiles, Roketsan, will demonstrate their unique and unrivalled smart munitions, missiles and guidance kits at the Eurasia Air Show between 25-29 April in Antalya

Next Generation Cruise Missile, SOM

The Stand Off Missile (SOM) is an air to surface cruise missile family for use against highly defended stationary and moving land/surface (ASuW) targets. Its modular design supports operational flexibility.

The first flight test of SOM was performed in 2011 and serial production started in 2013 under the contract between Roketsan and the Turkish MoD. As part of the serial production frame the production line qualification has been completed and the first batch of missile deliveries with the components of the SOM Missile System, including the Test & Programming Unit and the Captive & Dummy Training Missiles, have been successfully delivered. Further capability enhancement activities are still in progress within this contract.

A contract for the in-house development of a smart munition compatible with the F-35 Joint Strike Fighter, which will be based on the existing SOM technology, was signed in 2012 between Roketsan and the Undersecretariat for Defense Industries. Within this scope, SOM-J development activities besides the platform integration studies in collaboration with Lockheed Martin Aeronautics, the main contractor of the JSF Program were initialized in 2014.

A business partnership agreement was signed with Lockheed Martin Missiles and Fire Control (LMMFC) for the design, development, production and marketing of the SOM-J Weapon System in 2014 and the contract was signed in 2016. The integration activities of the F-35 are being carried out by Lockheed Martin Aeronautics, and these activities are scheduled to be completed in 2023. The SOM-J, specifically developed for intensively protected targets, developed for the F-35 aircraft, for sea and land targets, will be carried inside the airframe so that the aircraft maintains a low radar signature.

The SOM provides availability for adaptation to various missions due to its open architecture software. Composite materials are used within its structure and the radar absorbing material enables low visibility. The SOM provides the advantage of smaller size and weight, compared to similar systems with a 250+km range for the SOM and a 200+km range for the SOM-J. The SOM operational concept will be enhanced by in flight re-programming and network capabilities to be enabled by the integration of a data link.

Roketsan's MAM-L Boosts Effectiveness of UAVs

The Smart Micro Munition (MAM-L), developed by Roketsan in line with today's battlefield requirements, attracts attention as a solution that increases the efficiency of air platforms with low payload capacity, especially that of unmanned aerial vehicles (UAV). MAM-L, a variant of the Laser Guided L-UMTAS (Long Range Anti-Tank Missile System) that is also developed by Roketsan, the only difference being that it does not have a rocket motor and glides in the air has already been integrated to the BAYRAKTAR and KARAYEL tactical UAVs that are currently being used by the Turkish Armed Forces. The MAM-L, which is being successfully used in various operations involving UAVs, stands out as a munition that has proven itself in the field.

With its low weight of about 50 pounds and a length of 1 m, the MAM-L offers a cost-efficient solution for light attack aircraft as well as UAVs. The MAM-L, with its high explosive fragmentation warhead, is highly effective against light structures, unarmored ground vehicles, radar antennas and soft targets like weapon pits and personnel, in a 25 m radius. The other version with tandem high energy anti-tank warhead is effectively used against heavy armored tanks. The munition can be used efficiently at ranges of up to 8 km, depending

on the altitude from which they are released, and the range can be extended to 14 km with the Optional INS/GPS Version.

Meanwhile, the fact that MAM-L is a member of the same family with Roketsan's medium range anti-tank missile OMTAS and long range anti-tank missiles UMTAS/L-UMTAS, offers a significant advantage to its users in terms of training and logistics.

Roketsan also gained considerable experience in the integration of the MAM-L into air platforms. As long as the air platforms have the required infrastructure, Roketsan can operationalize the MAM-L by completing all the related integration work within a few months. In the event of the infrastructure requiring additional elements, Roketsan also offers its customers integration support.

Laser Guidance Kit TEBER

TEBER is a low-cost laser guidance kit that is attached to MK-81(250lb) and MK-82(500lb) general purpose bombs. TEBER converts the bombs into precision smart weapons using Inertial Navigation System, Global Positioning System and Laser Seeker.

TEBER's modular design offers affordable options. An add-on Laser Seeker which is located on the front section allows precise hit capability for moving, relocatable and maritime targets even if the target is maneuvering at high speeds. The Laser Seeker may be equipped with or without a Height of Burst seeker.

The TEBER tail kit can identify the bombs (MK-81/MK-82) which are integrated and it can be installed very quickly in the field with the Laser Seeker. Tail kit contains a Global Positioning System/Inertial Navigation System for precise guidance and aerodynamic control surfaces. Body Strakes supply additional lift and stability and the weapon maneuver capability.

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TEI to Exhibit Unique Products Powering Up National Platforms at the Eurasia Air Show

TEI, Turkey's leading engine and component manufacturer, is getting prepared to participate in the Eurasia Air Show which will be held under the auspices of the Presidency of the Republic of Turkey on 25-29 April 2018. During the 5-day Fair, TEI will exhibit the unique PD 170 turbodiesel engine to power national platforms, TS1400 turboshaft engine mockup, TJ90 turbojet engine, 5-stage blisk of the new generation LEAP engine and engine parts manufactured through the method of additive manufacturing

TEI, which increased its total domestic and foreign sales figure to \$320 million in 2017 and obtained \$268 million in total turnover from export sales, continues to grow on a global scale in civilian and military aviation engines and parts production with over 2,000 employees, 600 of which are engineers.

In 2017, TEI attained nearly 80% of its sales volume from the production of civil aviation engines and the remaining 20% from the production of military engine parts and modules, product development and AIT & MRO activities. Today, TEI has more than 800 different production parts in its portfolio.

The Biggest Supplier of LEAP Engines in the World

While TEI assumes a major responsibility for the new generation LEAP engine, it is producing many critical parts of this new generation engine on its own which powers the new generation A320 Neo and Boeing 737 Max aircrafts, and is the world's biggest engine part supplier of LEAP engines.

An agreement was signed between GE Aviation and TEI on 26 September 2013 for the manufacturing of compressor blisk parts of the LEAP engine at TEI facilities. Within this scope, 5-stage blisk parts of LEAP engine are being produced at TEI facilities, and TEI's Advanced Manufacturing Technologies facility is one of the two facilities



that is capable of manufacturing compressor blisk parts for this engine.

This facility which will be TEI's first digitally intelligent factory, incorporates features such as production planning based on real-time data, process optimization, real-time parts and parts motion monitoring system, intelligent systems based on warnings and prevention mechanisms, preventive maintenance depending on real machinery data and paperless



© TEI

TS 1400 Turboshaft Engine

manufacturing as well.

Today, approximately \$2.2 billion of this finalized backlog is composed of the parts that will be manufactured until 2035 for the LEAP engine.

TEI's Unique Engines to Power National Platforms

TEI has gained significant capability and know-how since its establishment through the investments made also for military aviation engine and part production and is assuming critical responsibilities in indigenous projects initiated by the Undersecretariat for Defense Industries (SSM) to power the national platforms such as TS 1400 Turbo Shaft Engine Development Project, Operative UAV Engine Development Project and National Turbojet Engine TJ90 Project.

At the engineering offices of TEI in Eskişehir, Ankara and

Istanbul, a strong team consisting of 250 engineers specializing in Aerothermal Engineering, Structural Engineering, Product Engineering, as well as in Engine Prototype and Testing, Electrical / Electronic - Control and Embedded Systems disciplines was established for the Turbo Shaft Engine Development Project which was initiated for the integration of an indigenous engine developed with the domestic facilities with the T625 Multi-Role Helicopter and the contract of which was signed between SSM and TEI on 07 February 2017; substantial investments were made for the infrastructure.

The development program which is scheduled to last for a total of eight years as per the project model consists of 5 stages: development of the core engine, prototype engine stage, mature engine stage, certified engine stage and integrated engine stage. Following the successful completion of all stages, the developed 1400hp turboshaft engine is planned to be integrated to the T-625 Multirole Helicopter and certified.

With the achievements obtained during the development process, the gas turbine engine design and development infrastructures are aimed to be

built in Turkey and the versions of the engine to be developed in the future are aimed to power other national platforms such as T129 "Atak" and Hürkuş.

PD170 Engine to Power up the "Anka" UAV Platform and Potential for Other Platforms

The development contract was signed between SSM and TEI on 27 December 2012 within the scope of the Operational UAV Engine Development Project which was initiated to develop a unique turbodiesel engine that would be a solution for the requirement of "Anka" and similar class UAVs. A decision was made to increase the engine power from 155hp to 165hp as a result of the negotiations between SSM, TEI and TAI regarding engine power, weight and fuel consumption which are the basic parameters of the engine, during the first phase of System Requirements Identification Phase that is the first phase of the project, with the aim to develop a unique UAV engine with superior features on a global scale.

During this period, a 170hp power engine target was set and the engine architecture was designed to support 210hp by taking into account the



PD170 Turbodiesel UAV Engine

future requirement of "Anka" configurations.

The PD170, with its dual-stage turbocharging system and fuel consumption, has achieved significant performance values amongst its competitors. The PD170 engine achieves this result with its high in-cylinder pressure resistance, high fuel pressure, low friction losses and thermodynamic gains from dual-stage turbocharging. It is expected that the PD170, which also has a better power / weight ratio than most of its competitors, will be in the leading position on the global scale with its 210hp version.



TEI delivered one of the first prototypes to TAI on 14 November 2017 for the purpose of performing the ground tests and to be used for “Anka” integration. The design changes realized by TEI in the following period will be applied to the engine that is present at TAI together with the prototype engines, the tests of which are being conducted at TEI test systems. The related studies will be conducted to prepare the engine for the first flight test. Within the scope of the project where the integration studies conducted by TAI are aimed to be completed in a short period of time, the first flight test is planned to be performed under limited conditions in the first half of 2018. Through this test, the verification of engine-aircraft integration will be achieved rather than a verification activity regarding the engine. In addition to validating flight data for verification of engine-platform integration, verification of altitude-conditioned tests performed on the ground by TEI will also be achieved.

Taking into consideration the needs of other possible platforms other than just for “Anka” has opened new doors for the PD170 engine. Thanks to the dual-stage special turbocharger system, the PD170 will be the first and only turbodiesel UAV engine in the world capable of operating at 40,000 ft. In the design process, considering the future needs, the main systems of the engine were designed to meet 210hp. With the improvements to be made in this regard, it will also be possible to increase the engine power to 210hp.

TJ90 Turbojet Engine Made its First Flight with High-Speed Target Drone “Şimşek”

TEI will also exhibit the national TJ90 turbojet engine designed and manufactured by TEI with features such as electric start, resistance to catapult loads, ground station data-linked engine control unit and which can provide 400N impulse at maximum speed (under sea level conditions).



© Defence Turkey

The TJ90 turbojet engine was integrated to Turkey’s first turbojet-powered, High-Speed Target Drone “Şimşek” in 2017 and made its first flight seamlessly at an altitude of nearly 10,000ft and a speed of 200 knots at the Sivrihisar military base region.

Wide Range of Parts are being Manufactured at Additive Manufacturing Technologies Center

TEI, which allocates a significant share to R&D investments from its own resources, has accelerated its infrastructure activities for additive manufacturing technologies thanks to the projects conducted with the support of the Undersecretariat for Defense Industries since 2013. In this context, particular importance was placed upon the creation of comprehensive know-how on the additive manufacturing process and related test work, training of qualified personnel, training and experimental work in order to increase their competence.

As a result of such studies, the necessary infrastructure for this technology was established in a short span of time. Within the scope of the YAKUT project, which was initiated with the support and funded by SSM in 2014, TEI has increased its

know-how in the manufacturing of aviation engine components by using super alloys through method of metal additive manufacturing and has taken its place amongst the countries that implement this technology in the world. The combustion chamber, consisting of 9 sub-parts of the TJ90 engine, was successfully manufactured in one piece through the additive manufacturing process in such a manner to provide the desired mechanical and metallurgical features. At the end of 2017, again with the support of SSM, it initiated a project called ELEKTRON (Melting Process Development through Electron Beam). As a result of the investments, many parts were successfully manufactured for different engine components of various modules with this technology which provides great time savings in the prototype manufacturing processes carried out within the scope of National Engine Projects (TJ90, PD170, TMGP etc.).

In the upcoming period TEI aims to perform the necessary certification (NADCAP etc.) activities in accordance with customer requirements and international standards in order to utilize metal additive manufacturing technology to create value both in the national and international arena ■

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helicopters, engine maintenance stands used for large maintenance of aircraft engines on the ground, engine lifting sling used for removing and lowering aircraft engines to the maintenance stands, hanging slings and conveying columns used for safely lifting and transporting large volume and heavy parts of air vehicles.

EMSA Group Engineering aims to be a brand that is reliable and durable in every field it serves with developing technology, respecting humanity and society, complying with legal, economic and moral principles, being sensitive to health, security and the environment, manufacturing products with high added value for its customers both domestically and abroad in the fields of maintenance, repair and ground support equipment manufacturing, without compromising Laws and Rules of Aerospace, keeping customer satisfaction at the forefront, reducing Turkey's foreign dependency on technological fields and performing innovative and qualified work in the Defense and Aerospace industry.

and equipment and ground support devices used in the maintenance of aircraft are of good quality, safe and easy to use.

While designing and manufacturing these products, safety and quality standards are kept in the foreground considering the ease of use and their weight. Experiences and knowledge of our staff who have worked in Military, Security and Civil Aviation sectors for many years, and our equipped engineering staff, provide solution-oriented, qualified and reliable services for the needs and expectations of our customers and users.

Eurasia Airshow 2018, which will be held in Antalya on April 25-29 this year, brings together the leading brands and industries of the Aerospace Industry. EMSA Group Engineering will be introducing its



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control of Plane/Helicopters on the ground, containers required for transportation and storage of helicopter engines, blade clamp kit used for removing and installing helicopters' blades, pressurized engine wash tubes used for washing hot and cold sections of engines of airplanes and



Turkish Defense Industry: Key Next Step in Evolution

By Osman Sadi Dereli- Alfa Global CEO

The Turkish Defense Industry has gone through various stages by the guidance and decisions made throughout the last three decades. The first stage was mastering the assembly of systems. The second stage was the sharing of production during procurements. Today, the Industry is capable of designing and manufacturing its indigenous products and systems. The next stage is to be an innovative and competitive industry which creates and develops its own concepts. Sadly, it can be said that the industry is slow in the transition to the next stage.

It is clear that countries which cannot produce their own Defense systems suffer from diplomatic and military difficulties because of their external dependence for national Defense. Turkey has taken considerable steps in leaving this problem behind following a long and costly processes. Nevertheless, avoiding the Available System Trap is Turkey's main challenge toward achieving indigenous military capability and building a competitive edge in the world.

The Available System Trap, as we define it, is the specification of future operational requirements of a system based on an existing concept. This trap is seen as a major barrier that may prevent the national Defense industry from manufacturing innovative military capabilities and competitive systems. The Available System Trap brings along a series of negative effects on military capability development and commercial competitiveness.

It can be said that this quandary is an Available System Trap, if the relevant criterion, which has been accepted, comes from an already available product that is conceptualized according to requirements of another country, such as geographic features, threat types and even doctrines. This results in skipping the most creative design steps, which will distinguish the system and make it advantageous over others. Also, the technical development of the system starts with assuming other countries' concept of operations directly or indirectly, which

may not be relevant to Turkey.

The Available System Trap causes planners to overlook potential innovative uses which may lead to asymmetrical affects and surprises in the future operational environment. Potential benefits of the final product are lost when the project falls into the trap. It's impossible to prevent the loss of accumulated knowledge that would be acquired from the project.

Considering long term development cycles and systems that are designed according to the features of existing systems without the analysis of future concepts, this means they are produced according to the concepts and requirements of previous decades. Therefore, even systems have been produced for the first time, they are coming out into the operational environment with decades old systems. Even though time and money have been spent well, technological initiative has been lost from the beginning.

Starting product design with available system concepts means redesigning existing products and aiming for an already occupied commercial market. While the opponents develop systems according to new operational concepts, those who fell into the Available System Trap try selling their "newly developed" systems in a competitive market.

Defining the future operational environment and concepts for developing Defense systems are only possible by analyses requiring a qualified workforce. Lack of attention to this matter was the reason why the Turkish Armed Forces was faced with the sole responsibility of conducting those analyses. Therein, the Turkish Defense Industry should play an essential role in the development of military concepts.

Moreover, in accordance with procurement regulations, users and system developers may come together after completion of the project definition step. This situation results in the designing of future operations and defining the requirements over existing concepts and systems. Until recently, the



improvements made have not aimed to overcome the Available System Trap.

The Turkish Defense Industry should directly take part in operations analysis and concept development steps along with the relevant departments of the Turkish Armed Forces in order to not fall into the trap. In the short term, the consultancy firms which provide field expertise in concept development and testing areas should be supported or added to the projects directly by the Undersecretariat for Defense Industries.

It is obvious that avoiding the Available System Trap is impossible without thinking long term. Together the Turkish Defense Industry and the Turkish Armed Forces need to create a cooperative environment where the users and system producers can gather before the concept design of projects. Therefore, they can define user requirements and get through the process of developing the concept of operations together. The purpose of this environment should be that of combining perspectives of experts in the field of operations with engineers in the development domain.

Such an environment properly formed and introduced to the ecosystem will reveal influences of cutting edge technologies in operations. Moreover, it will also be highly beneficial for companies by using new technologies to create completely new markets.

Alfa-Global provides services and consultancy in the fields of Defense capability planning, operational environment analysis and concept development for the Turkish Defense Industry to overcome this significant hardship. Alfa-Global will also continue to put forth effort and resources to draw the industry's attention and to express suggestions so that Turkey can transform this difficulty into an advantage.



The Quality of Flights Rises with TGS

Turkish Ground Services (TGS) is a leading ground handling company providing ramp, operations, cargo and passenger services at the main airports in Turkey: Istanbul Ataturk (IST), Ankara Esenboğa (ESB), Izmir Adnan Menderes (ADB), Antalya (AYT), Adana (ADA), Istanbul Sabiha Gökçen (SAW), Milas-Bodrum (BJV) and Dalaman (DLM). Working within a framework of safety and security regulations, TGS provides a high-quality service while ensuring customer satisfaction remains the company's main priority. TGS has nearly 7,000 pieces of equipment and more than 10,000 qualified staff working towards a common service concept. The company serves over 700,000 flights per year for both domestic and foreign airlines. With a solution-focused approach and high-quality service, combined with a price advantage, TGS aims to ensure customer satisfaction. The company's vision is to be a leading ground handling company preferred for its quality, reliability and competitive power. In accordance with this mission, the company's target is to be the biggest handling company in



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Europe, as well as offering services in various European countries in the medium term.

Ramp Services

- › Loading and unloading of the aircraft (including transferring bags and Cargo to the aircraft or terminal)
- › Aircraft cleaning
- › Passenger transfer
- › Pushback and towing
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- › Clean and waste water services
- › De/anti-icing

Operation Services

TGS provides a variety of operation services to handle and coordinate aircraft activities, including:

- › Aircraft Arrival: Making the necessary preparations related to the arrival of the aircraft. Checking the messages, arranging the bridge and bus as well as sending the necessary equipment to the parking position to load and unload baggage and cargo.
- › Aircraft Departure: Flight following; sending meteorological information, flight plans and other documentation to the crew; completing ground and safety inspections in or under the aircraft prior to departure; following documents and procedures from the airline; meeting with the captain and purser prior to departure; sending the required messages after departure (MVT, LDM, CPM, PSM and

so on); helping to coordinate fueling and catering services; manage weight and balance calculations for the aircraft according to the distribution of the baggage and cargo.

- › Cargo Handling Services: General Cargo admission, special cargo processing (including dangerous goods, valuables and perishable cargo), air mail processing, transfer and customs processing, documentation processing.

Passenger Services

TGS provides assistance with check-in (including VIP, CIP, self and group) and boarding, passenger and baggage admissions, ticketing, counters for special considerations (for example, passengers with children), and services for passengers with reduced mobility. The company can also assist with the inspection of travel documents, passports and visas and can provide guidance for transit passengers checking-in or transferring, as well as helping passengers with lost or damaged bags or those who require a hotel.



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Plenty of Alternatives for Everyone at ER-AH

Having started its journey in the aviation sector in Isparta in 1991, ER-AH founded the ER-AH Flight School in 2008 in order to raise Turkey's best pilots and contribute to Turkish Civil Aviation through the know-how and experience it acquired over nearly 20 years of serving in various branches of the sector.

The training adventure began in 2009 in Antalya with the ER-AH Flight School training building and 3 Cessna model aircrafts. In 2014, it completed the construction of the first major investment which is a 1.000 m² aircraft maintenance hangar and flight training building. At an area of 1.000 m² opened as a theoretical training center in 2015, it has been delivering training services to candidates who want uninterrupted training.

The ER-AH Flight School has been providing theoretical, synthetic and flight training at its facilities located in Antalya, Istanbul and Isparta. ER-AH Flight School is one of the best flight schools in Turkey which is authorized to give flight and theoretical training, ranging from private pilot license PPL (A) to air transportation, pilot license Modular ATPL (A) Frozen and Integrated ATPL (A) Frozen training.



The ER-AH Flight School, which gives both modular and integrated training to employees on a 90% distant training basis, graduates its pilot candidate students within 16-18 months.

At the ER-AH Flight School, flight and ground training are given by pilots who have years of experience in airlines, captain pilots, aircraft engineers, meteorology engineers, air traffic controllers, flight planning experts, aircraft maintenance technicians and medical doctors.

ER_AH Provides 120 hours/day and 21.000 hours/year flight trainings, with its total 18 Aircrafts (16 Single Engine: Cessna 172 Glass Cockpit, 2 Twin-engine: Piper Seneca V and Tecnam P2006T), total 6 Simulators (Alsim ALX, Redbird Elite, IDS ve A320 Fixed Based Procedure Trainer), 120 Staff, 45 Instructor, 250 Pilot Candidate training capacity, 600 Graduated Pilot Candidates, navigation flights to 20 different airfields, 320 of flightworthy days in a year, 70 flight trainers capacity on daily basis.

ER-AH Aviation has made every investment that it has made for 26 years by focusing on people and by adding value to candidates and Turkish Civil Aviation. It has made a difference in the sector with its solutions, services and expertise.

The pilots that ER-AH Flight School has trained for SunExpress, Turkish Airlines, the Turkish Armed Forces, Turkish Aeronautical Association University, Okan University and for the National Police. These are important references in the Turkish aviation sector and of course they have been a source of pride for ER-AH.





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Turkish Aerospace Industries, Inc. (TAI) a global center of technology in design, development, modernization, manufacturing, integration and life cycle support for integrated aerospace systems, from fixed and rotary wing air platforms to unmanned aerial vehicle (UAV) systems and space systems.

T129 “Atak” Advanced Attack and Tactical Reconnaissance Helicopter

T129 “Atak” Advanced Attack and Tactical Reconnaissance Helicopter, an optimization masterpiece developed to meet and exceed the specific harsh requirements of the Turkish Armed Forces has proven its worth as a superior alternative in its class.

Having successfully satisfied the Turkish Army, there is now a very strong international interest in the T129 “Atak”. Until now, the T129 “Atak” has been successfully deployed for several tests and demonstrations in various locations of the world including Turkey, Poland, Pakistan, Germany, Italy, South Africa, Bahrain and the United Kingdom. As of October 2017, 30 Helicopters, of the contracted 59, were delivered to the Turkish Armed Forces within the scope of the Turkish “Atak” Program and they are actively participating in peacekeeping operations.

Anka Multi-Role ISTAR MALE UAS

Anka is a multi-role ISTAR (Intelligence, Surveillance, Target Acquisition, and Reconnaissance) MALE UAS that is capable of operating day / night and in adverse weather conditions. The system has more than a 200 kg payload capacity, 24hrs endurance and can fly at an altitude up to 30,000ft.

Anka is fully autonomous and has an ATOL-Automatic



Takeoff and Landing System with GPS and Radar Based fully independent sensors. The air vehicle takes-off and lands on the runway on its conventional tricycle retractable gear. The whole composite airframe is composed of a mono-block fuselage, detachable wing, V-Tail, retractable landing gear, dual redundant flight control sensors & surfaces, qualified avionic equipment, and service doors. The system is powered by a pusher type heavy fuel diesel engine. It can carry EO/IR HD optical/thermal/laser multi sensor system and Synthetic Aperture Radar (SAR) payloads simultaneously. The EO/IR payload is capable of detecting, identifying, tracking and laser pointing targets from distances up to 40km. The SAR payload provides high resolution imagery even through clouds at a standoff range up to 37km and supports both maritime and land surveillance. Anka UAS has Radio Relay capability and optional payloads such as ESM/ELINT and COMINT Systems for SIGINT missions and Wide Area Surveillance System (WASS) for improved larger area surveillance and reconnaissance missions. The aircraft is equipped

with a wide bandwidth LOS data link. This link capacity can accommodate payload, pilot cameras and telemetry/telecommand throughput needs up to 200km away from Ground Data Terminal (GDT). Through hand-over feature operations can be conducted over areas outside of LOS range. The data link system is fully redundant and works within different frequencies. It has encrypted communication capability. The System has Beyond LOS (SATCOM Capability) option as well. Anka has also an ATC transponder and a UHF/VHF radio on board for Air Traffic Communication. All airborne and ground-based flight control software is developed by the TAI (Turkish Aerospace Industries, Inc.) Design Team. Ground troops can also receive real time imagery from Anka through Remote Video Terminal (RVT) to improve their situational awareness.

The Anka Air Vehicle is controlled through a Ground Control Station (GCS) for mission planning & analyzing and controlling & monitoring the UAV. The mission can also be observed and analyzed at an Image Exploitation Station at headquarters that have data



network access to the GCS. The system is fully-portable and can be broken down in sections for airlifting by C-130 and A400M transport aircraft.

Anka Block-B in Service with Diverse Payloads

Several variants of the Anka system with New Generation EO/IR Camera, Radio Relay, ATC Com. and Elint/Comint is currently operational and providing service to Turkish Security Forces.

Hürkuş-C Light- Attack Armed Reconnaissance Aircraft

Hürkuş-C is designed as a Light-Attack Armed Reconnaissance Aircraft in addition to its main role of Flight Training. Although the main role of this aircraft is to provide basic

flight training, it also proposes low cost and high accuracy solutions to Light Attack/Armed Reconnaissance missions. Electronic Warfare Systems are integrated to Hürkuş-C against ground-based air defense threats.

T625 Multi-Role Helicopter

The helicopter incorporates several new technology features to provide operators with the highest levels of safety and operational benefits. Critical systems such as transmission, rotor and landing gear as well as aerostructures and avionics systems are designed from scratch. A new generation, advanced aerodynamic indigenous rotor design will provide excellent performance in the most demanding of operating environments. The T625 design also benefits from extensive use of composites, advanced airframe

aerodynamics, next generation wide screen digital cockpit design and state-of-the-art avionics for maximum situational awareness.

The first prototype design was completed as of October 2017 and the manufacturing process has since started. The T625 is expected to perform its first flight in 2018 and set to be in service early 2020s.

Turkish Fighter (TF)

The Turkish Fighter will be a 5th generation multi-role aircraft. It will be designed mainly for an air-to-air role with a consideration for an air-to-ground role as well. Upon engineering analysis, preliminary calculations, based on information received from suppliers of candidate engines, a decision was made that the TF aircraft will be a twin-engine configuration.





BNA

Nurol BAE Systems F

BNA – Bridging the Gap Between Platform Owners and Equipment Level Manufacturers, Driving Local Business

In this exclusive Defence Turkey interview, BNA General Manager - Mr. Eray Gökalp discusses BNA's role in helping local Turkish component providers take part in the industry more actively through collaboration on safety critical flight systems, control electronics, human machine interfaces, low observability and simulation technologies

ntegre Sistemler
Teknoloji Merkezi

MA

Hava Sistemle



Defence Turkey: First off, thank you very much for your time. Could you please tell us about the structure of BNA, the work shares of Nurol and BAE Systems as well as the history?

I would like to thank you for this opportunity. BNA is an aviation and technology company that has emerged from the joint venture of two giant companies. BNA is a synthesis of experiences gained so far by Nurol Holding and BAE Systems.

BNA targets the niche areas not yet occupied by Turkish companies, in order to provide these products and services to domestic and international markets. BNA intends to capitalize on the strengths of both shareholders, utilizing Nurol Holding's established local position and infrastructure alongside BAE Systems' experience and technology. Our vision is to become a tier 1 supplier of products and services developed in Turkey and to achieve this goal through the establishment of local R&D program; delivering design and built work packages and building local capabilities complementing existing industry strengths.

BNA's business strategy has been developed mainly around the aviation sector. The safety critical and complex nature of air vehicle systems and of the required infrastructure will also allow exploiting this capability for a competitive advantage in adjacent sectors.

Although our company was established only recently, we have successfully carried out our short-term Business Strategy and developed our infrastructure, drew up our corporate processes and our code of governance, received our ISO 9001 and AS 9100 quality certifications, established our engineering laboratories and launched our critical investments. With a rapid yet controlled growth, we have had a successful period in which we increased the number of engineers in our staff to 30 and the total number of staff in our company to 39. Throughout this

process, we moved from ODTÜ Teknokent – where we started our operations – to a larger facility at Bilkent Cyberpark, in order to keep up with our growth. With the running projects, we are aiming to increase our number of employees to 60 by the end of this year.

Defence Turkey: It appears that BNA focuses on flight control, engine control, fuel and environmental control systems technologies. What are the BNA's core capabilities, technologies and products?

Our main business areas are developed around Integrated Flight / Vehicle Systems, Integrated Mission Systems, Electronic Systems, and Training and Simulation.

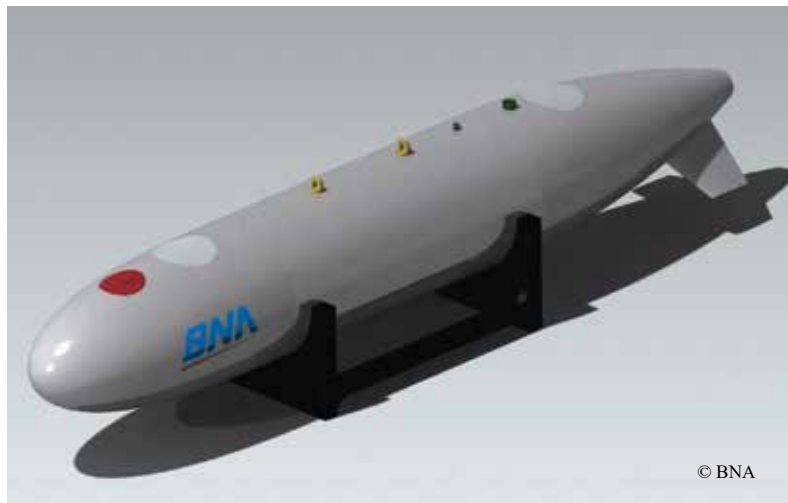
As you mentioned, our core area of interest is control systems and our primary focus is the aviation industry. Flight systems or vehicle management systems, engines and mission systems all contain a control function, as well as an electronic unit that enables this function. We will procure the components preferably from local sources and provide an integrated system around the control unit to be developed by BNA. That's how we will be providing ready-to-use subsystems to platform manufacturers. That is exactly what the term "tier-1 system provider" – which is mostly used in civil aviation – refers to. To give you another example with fuel systems; world-renowned aircraft

manufacturers are not directly in contact with the companies that produce the subcomponents of this kind of system. They only know the company from which they purchase the fuel system. In this way, aircraft manufacturers no longer have to bother with managing numerous suppliers and developing subsystems. We think that in our country there is a gap between platform owners and equipment level manufacturers.

We can very well assume a role in helping the component providers – and especially the local companies – take part in the industry more actively. We can do this by collaborating with them.

On the technical side, most members of our team are already experienced in the industry, which makes a big difference. For many years, we have already been carrying out our activities with a good understanding of the need for technical, certification and qualification standards. We speak the same language with platform manufacturers who act as prime contractors. In this regard, we're closely keeping track of the developments in Turkey's capabilities.

In parallel with the technical aspects, tier-1 providers need to be as resilient against economic fluctuations as the prime contractors. BNA's partners, namely Nurol Holding and BAE Systems, inspire great confidence in this regard.



© BNA

BNA designs and develops auxiliary fuel system for air platforms

Defence Turkey: Could you please inform us about on-going programs in Turkey? Do you have any plans to be involved in the T129 “Atak”, Hürkus-C and T625 Multi-Role Helicopter programs?

BNA has set off with its entirely indigenous and qualified engineering workforce to undertake aircraft system design and manufacturing activities. Turkish helicopter projects, such as the T129, T625 and the New Atak as well as the fixed wing projects for the TF-X, Hürkuş and Hürjet are big projects and our goal is to become a reliable system provider of TAI in these challenging projects.

In the context of these programs, we are targeting to indigenously develop critical aircraft subsystems and to then conduct their platform integration as well as aircraft level tests together with TAI.

Within the scope of TF-X and Hürjet programs, we invest in capability development to position ourselves as local system provider of digital flight control systems with active sticks. We are also continuing at full speed to work on infrastructure development and engineering capability-building activities for the development of engine control systems for indigenous engine development programs. The project contract we signed with the German engine company AES, which is a joint-venture between MTU Aero Engines and Safran, is the first and most important step of this work. This is an export project that BNA won under competition and positions BNA strategically to be eligible for further Full Authority Digital Engine Control (FADEC) developments.

In line with the development of an integration and test infrastructure, BNA will carry out its high technology system integration, assembly and test activities at the simulator and system integration laboratory, which is currently being established. At our laboratories, we will carry out work on the



Mr. Eray Gökalp informed Mr. Cem Akalın- Managing Editor of Defence Turkey Magazine about BNA's unique active stick technologies

development of control software embedded in the subsystems of aircraft, prototype production and “Assembly at Line Replaceable Unit” level, software and hardware tests and certification.

Defence Turkey: BAE signed a definitive contract with TAI to T-FX Program in the last period. Within the light of this contract, how do you assess BNA's position in this program?

Being a local aerospace company in Turkey, we are investing and working hard to be a part of the TF-X Program. As BAE Systems is one of BNA's shareholders, we have an opportunity to reach BAES's significant success story and background in fighter aircraft and sub-system design, development and support technologies. BNA's vision is to be a competent company to fill the niche areas of the Turkish Aviation Sector by exploiting capabilities from our shareholders. We are targeting to be TAI's qualified system supplier for the TF-X Program. We are fully aware of TAI's demands in respect to their sub-contractor/supplier selection processes and requirements, as such we conducted initiatives and started early investments to satisfy these requirements. These investments are being made in

our infrastructure in terms of building capability, capacity and developing the best value to this very important indigenous program. Again, our main focus would be on safety critical flight systems, control electronics, human machine interfaces, low observability and simulation technologies.

Defence Turkey: At IDEF 2017, BNA signed a MoU with the German company AES to develop motor control systems. Could you please share with us details the latest status of this collaboration and program?

We believe it is a very important step for BNA that AES has decided to cooperate with BNA for the development and production of the state-of-the-art Engine Control System which is considered to be the brain of the engine. We, on behalf of our country, are very proud of this cooperation. We think that the most important precondition to be considered a technologically superior company that has a say in the global defense and aerospace industry is to be able to export technology products to industrially developed countries. Our first contract was signed and now effectively we can export high level technology to a European main contractor. We think that this is a good start.



The said engine control system is being designed for the control of engine parameters and provides features like health and usage monitoring. In the context of the project, we will develop the system, produce the serial units and secure life cycle management.

This project will have both technical and administrative ramifications. On the technical side, we expect this project to act as leverage for the development of the FADEC system by BNA within the context of the various engine development projects in our country. BNA will gain significant capability and reference by developing a system that operates in an engine that is widely used in the international market.

We, at BNA, have won this project by proving our competent workforce and processes. The project does not include an offset obligation. We have demonstrated to our partners that we are able to create export potential as long as we focus and work on the right areas and I believe that this contributed to increasing our reliability.

Now we are very close to the PDR phase of the program and our customer is very satisfied with the results. The next phases of the project which lead us to serial manufacturing of the control unit are about to start.

We believe that this project will also serve as a model for foreign companies willing to do business with Turkey.

Defence Turkey: We know that BNA heavily invests in engineering capabilities and R&D infrastructure. What are the R&D investments and ongoing programs with companies in Turkey as well as global markets?

There are two leading engineering and R&D departments in our company, namely the Directorate of Integrated Flight Systems and the Directorate of Electronic Systems. Graduates from the aeronautics, aerospace, electronics, computer, and mechanical engineering departments of leading universities are working in these directorates, together with engineers experienced in critical projects. Our colleagues in our Engineering and R&D team are well-versed in their respective fields of expertise and have an average of 16 years of experience in the defense and aerospace industry.

At this point, BNA succeeded in signing 2 (two) other national and international R&D projects in a short period apart from our contract with AES; we signed an agreement with BAE Systems for Virtual Reality Human-Computer

Interface Development. The project is related to Human-Computer Interface by which development and remediation of Virtual Reality applications and development potential for new applications will be defined. The developed system will include more up-to-date and new technologies than current Virtual Reality applications in Turkey. This project will be a first in Turkey and it is foreseen that it will draw considerable interest of companies which have virtual cockpit products and those that act on computer aided digital model design management or similar fields.

The other project agreement is related to Diagnostics Dashboard Development. It was signed with FNSS for a software development project by which all data of wheeled/tracked tactical combat vehicles being transferred can be displayed, dimensions of these data can be changed and placed effectually on a tablet. At the end of this project, the developed product will provide import substitution and domestic software will be developed which will be specially designed for the display requirements of combat vehicles. The most important outcome of this program is that we are aiming to design a Health and Usage Monitoring System as a second phase of this project which can be converted and adapted to air platforms as well.

We consider 2018 as a year of great potential, during which we will be aiming for significant turnover regarding sales figures and total development efforts. Our plans include developing critical systems for all tactical vehicles, particularly for aircraft, as well as implementing the relevant production projects.

Defence Turkey: AS 9100 is widely adopted and is a standardized quality management system for the aerospace industry. BNA has become AS 9100 certified recently. How do you evaluate the certification process as well as the benefits?

The BNA Quality Management System is currently based on ISO9001:2015 Quality Management System Requirements and AS9100:2016 Rev-D Aerospace Series-Quality Management System. Thanks to the fact that our experienced core team has a quality background, we were able to draw up our quality processes and procedures together from scratch. As you know, AS 9100 is an essential requirement for aerospace manufacturing programs. We are pleased to have a robust quality system and readiness for potential production projects.

Defence Turkey: Within the scope of your investment plan, what is your approach on reversing brain drain?

The systems we are working on are progressing in line with the platform development process. For instance, there is a flight control system that needs to be developed in line with the flight sciences analyses of the relevant aircraft. It is a highly flight-critical and priority system that has an interface with almost all other systems on board. If you intend to design such a critical system, you need to rapidly employ a qualified team of engineers from different disciplines and to also make investments at the earliest point possible for your facility, processes and engineering tools. You need to begin working together with the aircraft manufacturer in an integrated manner and with a proactive approach. As I mentioned, we, at BNA, are going through a controlled growth process, with an outlook to become a company that is preferred by prime contractors through our prioritized systems such as flight control and engine control systems. Being aware of our responsibilities in our areas of focus, we are working to achieve controlled growth in line with our corporate identity and concept.

Power is where people believe it is. We embrace the concept that "Knowledge is power, and that power is power by itself".



We entered the industry with the knowledge of our team of experts and also with an entrepreneur's spirit and an average of twenty years of experience in the industry, particularly in the field of aerospace. We also have power stemming from the support of two giant partners with more than half a century history in the industry. These features have allowed us to commence our operations one step ahead of similar enterprises. As long as we are granted the opportunity to assume a role, our goal is to become a company that conducts work in engineering development, together with the significant platform manufacturers in our country. We believe that no success is the product of coincidence and we are moving ahead on our path with firm steps, with a corporate culture that is mature and enthusiastic at the same time.

Regarding human resources, we of course cannot say that there are ample human resources in Turkey in the field of aviation. We are expanding our workforce by especially evaluating the job applications of promising young engineers and of Turkish professionals who are eager to return from abroad to Turkey by reverse brain drain or who may decide to return specifically to

work with us. We have already been successful in employing several Turkish engineers from abroad.

We are a Turkish company. All of our existing employees, especially our engineers and technicians, are citizens of the Republic of Turkey. Our primary objective is to improve our indigenous capabilities by having support from our shareholders.

Defence Turkey: Would you like to add another message to readers of Defence Turkey magazine?

The Eurasia Airshow is an important event for the Turkish Aviation Industry since it gathers both global and regional players and provides a platform for all the stakeholders of the ecosystem to communicate and share views. Such an international organization also serves our country in becoming a member of the global market as well as supporting commercial bodies with their goals. Therefore, BNA is pleased to take part in the Eurasia Airshow and is happy to cooperate with Defence Turkey for this special issue.

On behalf of the BNA Team, I would like to thank Defence Turkey for such a valuable interview ■

Havelsan Assertive in Civil Aviation

Havelsan will participate in the Eurasia Airshow, which will be organized at the Antalya International Airport on 25-29 April and more than 100 thousand professional visitors from more than 100 countries are expected to attend, with its indigenous products in the aviation sector, especially in the area of Civil Aviation.

The visitors will have the opportunity to experience a live demo of the Seatback Screen In-flight Entertainment System, Wireless In-flight Entertainment System and Boeing 737 Cockpit Procedure Trainer products and at the same time get detailed information about Havelsan's other aviation products from authorized personnel at booth no 416.

Founded in 1982, Havelsan, a leading technology company and Turkey's integration company worldwide, has been developing indigenous systems for military, public and private sectors within the country and abroad, offering smart solutions with today's latest technologies.

- › Havelsan's four main areas of activity are as follows:
- › Command Control Defense Technologies
- › Training and Simulation Technologies
- › Information and Communication Technologies
- › Homeland Security and Cyber Security Solutions

Civil Air Transport in Turkey is growing every year with increasing momentum. For example, according to the report of the Airports Council International (ACI) Europe, while the number of airport passengers in Turkey grew by 17.5% in February, the increase remained 6.5% throughout Europe. In parallel with these developments, primarily THY and other domestic airline companies are procuring new aircraft from producers such as Boeing and Airbus, and giant projects such as Istanbul's 3rd Airport are being actualized. THY plans to have more than 500 aircraft in its fleet in the upcoming years.

Havelsan has assumed responsibility to eliminate foreign dependency of our country in the field of civil aviation technologies and

has initiated various projects in the field of Civil Aviation in order to utilize know-how and experience acquired in the field of military aviation.

The first of the projects realized within the framework of this strategy is the In-flight Entertainment and Internet System which was jointly accomplished with Turkish Technic, one of the largest Aircraft Maintenance and Repair companies of Turkey and our region. With this project, the in-flight entertainment system, which has European Aviation Safety Agency EASA certification, was domestically developed for the first time in Turkey for the commercial platforms of aircraft manufacturers such as Airbus and Boeing. Thanks to this certificate, a product has been achieved that can be exported worldwide. The first customer of wireless and tablet-based systems was Turkish Airlines. The Wireless In-flight Entertainment System was installed on THY's 44 narrow-bodied passenger aircraft and is scheduled to be available for passenger use in the coming days.

Havelsan is a world-wide brand in the development of full-mission, partial-mission and full-flight simulators. Many projects in the military area have been successfully completed and customer deliveries have been realized. Havelsan has also achieved a first in the field of civil aviation flight simulators and developed Turkey's first domestic Full Flight Simulator for Boeing 737 NG commercial aircraft and realized its installation at the Turkish Airlines Flight Training Center. The simulator, the production of which

was completed, has a Level-D certification, the highest approval of the EASA European Aviation Safety Agency for simulators. Thanks to this certificate, a civil aviation product has emerged which can be exported worldwide as it is in In-flight Entertainment Systems. In addition to the B737 NG full flight simulator, development studies are continuing also for commercial air platforms such as the B737 MAX, A320 NEO. Havelsan aims to become a worldwide player in the field of civil commercial air platform simulators as it is in the field of military simulators.

Participants who visit the Havelsan booth at the Eurasia Airshow will have the chance to see live demos of the In-flight Entertainment Systems as well as the B737 Cockpit Procedure Trainer within the scope of Full Flight Simulators.



A Tenable Energy Solution, Fuel Cells by TEKSIS

The aviation sector is a significant player in the realm of the global energy crisis and climate change. Since the 1980s, CO₂ emissions from aviation have increased by 3.6% per year. As a result, aviation currently accounts for 12% of transport-related CO₂ emissions and 2–3% of all anthropogenic emissions with a steadily increasing influence. In order to tackle this challenge, the European Commission formulated reduction targets in the “Flight Path 2050”: 75% CO₂ reduction per passenger kilometer relative to the capabilities of typical new aircraft in 2000, as well as 90% NO_x and 65% perceived noise reduction. Similarly, two US government agencies, IATA and ICAO, pursue an average improvement in fuel efficiency of 1.5% per year until 2020, a cap on net aviation CO₂ emissions from 2020 (carbon-neutral growth) and a 50% CO₂ reduction until 2050. A tenable solution would be the use of hydrogen as fuel. Because its gravimetric energy density is three times higher, using hydrogen can reduce overall weight of the aircraft. This effect is pronounced in fuel-intensive aircraft like long-distance, large passenger number, and hypersonic aircraft. Once hydrogen is used as a fuel, there is no better converter than a fuel cell. The increased efficiency of a fuel cell leads to a further reduction of the fuel load. Fuel cells enable further advantages of electric aircraft such as distributed propulsion, which increases the aerodynamic efficiency. Furthermore, multifunctional integration of the fuel cell into aircraft via harvesting by-products, such as water, heat or oxygen-depleted exhaust air, allows for using the fuel cell to provide vital processes like de-icing, cabin air conditioning, water supply or fire suppression of luggage compartment or fuel tanks.



Defense forces look forward to self-sufficiency in every situation and location. Power and energy supply must be robust, reliable and versatile. Batteries are in wide use by the Army for their forward area detachments and by the Air force and Navy for autonomous vehicles and remote operation fields. The concept of fuel cell has undergone numerous innovative up gradations and has got adapted and diversified into several types. Low acoustic signature, low thermal signature, practically no chemical emission, improved specific energy, high energy density, reduced recharging cycle times etc., are important features of fuel cells weighing against the best of battery choices, as far as the military segment is concerned. These features are of significance to the civil sector as well. Fuel cells are power on demand devices based on electrochemical energy conversion. In batteries the stored chemical energy is released as electrical energy. Once the reactants are consumed, the battery stops delivering power and needs to be recharged using electrical energy from external sources. In fuel cells, though electrical energy is generated through electrode reactions, the reactants per say are not stored in the cells and can continue to give a rated power output as long as supply of the fuel and oxidant could be maintained.

Simplicity, durability, ruggedness and high level of autonomy, are essential features of any military hardware. Air force bases in forward areas and remote locations need assured electric power for battery charging, auxiliary power for surveillance and regular power for communication equipment. Long endurance unmanned aerial vehicles also need agile power sources. The Navy’s strategic need for electrical power is for running of the unmanned underwater vehicles and air independent propulsion systems for non-nuclear submarines. Based on the typical operating environment and user perspectives, the army’s power requirements can be classified into soldier power, auxiliary power units (APU), autonomous systems, distributed power plants etc. It



has carried out a comprehensive study and has identified the distinct areas, as soldier wearable and portable power, auxiliary power units for ground vehicles, ships, and aircraft, non-tactical light-duty vehicles, propulsion power for ships, submarines, autonomous underwater vehicles (AUVs) and unmanned aerial vehicles (UAVs).

TEKSIS is a unique company in Turkey that was founded with the aim to be an R&D executing SME to serve the Fuel Cell Sector and to create new technologies for a Green Future, having a mission to provide rapid, reliable, practical and cost-effective solutions. The headquarter office is located in the Technology Development Zone which is named Metutech inside of the university campus of METU (Middle East Technical University), the Design & Development Office (DDO). TEKSIS, has engaged in many projects, which have been carried out for the purpose of producing commercial fuel cells, integrated systems including DM and PEM Fuel Cells, Electrolysers and Reformers, Storage tanks, piping as well as control units having particular hardware and dedicated software. TEKSIS currently is focused on the R&D studies for production of complete fuel cell systems with a diverse capacity and size especially for the defense, aviation and aerospace sectors with cooperating global universities, institutes, private companies, subcontractors and consultants.

ANTONOV Presents its Advanced Programs in Turkey

ANTONOV Company, the world-known designer of transport, regional passenger and special-purpose aircraft, presents several advanced programs, including two modifications of AN-178 freighter, AN-188 STOL military transport and an unmanned aircraft system project at Eurasia-2018.

The main feature of the 16t capacity AN-178-100 medium ramp transport airplane is the ability to carry a wide range of existing packaged freight (containerized and/or palletized). The 18t capacity AN-178T military transport variant will be able to perform logistic support of troops, parachute drops of small troop divisions or cargoes on platforms, carrying wounded persons, light vehicles and necessary equipment. In addition, the AN-178T will have such important characteristics as reliability, autonomous operation and combat vitality. This new cargo aircraft will be able to use a wide net of runways including those with artificial pavement and unpaved airfields as well as alpine aerodromes.

AN-188 advanced wide body STOL military transport will be able



to deliver almost all types of military cargoes weighting up to 47t to short unpaved airfields, to carry a wide spectrum of self-propelled and non-self-propelled, engineering vehicles, helicopters, personnel, wounded and sick persons, to perform aerial delivery of personnel and cargoes.

ANTONOV Company started development of an unmanned aircraft system intended to perform intelligence tasks and to attack ground targets. This system is being

designed to take into account the most modern requirements of UAS for such a system type. The new system will perform tasks using special-purpose equipment and different weapons.

ANTONOV intends to develop all the mentioned programs under wide international cooperation. The Company is interested in participation of enterprises of the Republic of Turkey in these advanced projects.



10 Years of Experience in the Defense and Aviation Sector O SSA, OSTIM Defence & Aviation Cluster

OSSA, OSTIM Defense & Aviation Cluster is a non-governmental organization that was established in 2008 to improve the competitiveness of the OSTIM Organized Industrial Zone. Working rigorously with its experienced and high-profile staff, OSSA provides consultancy for small and medium enterprises in the Defense and aviation industry while providing them with an opportunity to introduce their companies on both a local and international platform.

With the cooperation and support of SSM (Undersecretariat for Defense Industries), Republic of Turkey Ministry of Economy, OSTIM Organized Industrial Zone, KOSGEB (Republic of Turkey Small and Medium Enterprises Development Organization), ASO (Ankara Chamber of Industry), ATO (Ankara Chamber of Commerce), TUBITAK (The Scientific and Technological Research Council of Turkey), SaSaD (Defense and Aerospace Industry Manufacturers Association), SSI (Defense and Aerospace Industry Exporters' Association), Ankara Development Agency, OSTIM Metutech, University of Turkish Aeronautical Association, Gazi University, Hacettepe University, Atılım University; OSSA is efficiently conducting its activities with 190+ qualified members and 7000+ personnel in order to increase the share of domestic production and

to support the actions of the Turkish Defense Industry.

OSSA also serves as a bridge between the government and companies by carrying out its projects through the collaboration of professional staff, relevant governmental institutions and organizations. OSSA aims to increase the production of the needs of the Defense and aerospace industry and to render the firms in the cluster competitive in the international market, to become preferred sub-suppliers with increased cooperation and developed capabilities, penetrating into international markets. In addition,



OSSA cooperates with universities and organized industrial regions via technology transfer to SMEs and focusing on regional competitive advantages in a specialized sector to create competition with sub-supplier skill development.



Turkey's World Class Defense & Aerospace Business Forum: Industrial Cooperation Days in Defense & Aerospace (ICDDA)

Co-organized with OSSA, Turkey's premier defense and aviation cluster, and under the auspices of the Turkish Undersecretariat for Defense Industries, the fourth edition of ICDDA Ankara will be held from October 23-25, 2018 and positioned in the heart of the Turkish defense industry.

OSSA aims to assist large firms and SMEs involved in the global aviation and space industries, having civil and Defense applications, to explore specific markets and seize business and partnership opportunities. Our Aerospace Meetings offer business to business platforms, high level conferences and industrial tours to better comprehend aerospace business in targeted countries and areas having specific requirements and opportunities.

At the 3rd ICDDA event, which took place in October 2016, 5,400 registered bilateral business meetings were held among the participants with over 200 companies from 33 countries in attendance. In addition to the participation of many important companies abroad such as Airbus Defense and Space, Boeing, Dassault Systems, EADS, Leonardo Group, Lockheed Martin, MBDA, Navantia, Rolls Royce, Sikorsky and Thales, there were also main industry companies from Turkey such as Tai, Aselsan, Havelsan, Roketsan, FNSS, TEI, Istanbul Shipyard, MKEK and Otokar who also participated in the event.



ARTI, the Defense Industry's Notable Partner in Military Electronic Design and Production

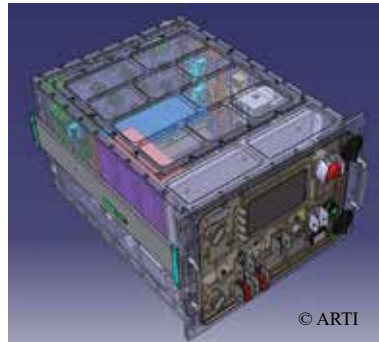
ARTI Endüstriyel Elektronik was founded in 1995 in Ankara and is known for its custom designs developed for defense and industrial electronic systems. It makes electronic and mechanic designs, performs prototype and mass production and provides maintenance and support services in various fields such as power electronics converter design, power distribution, land and railway electronic signaling, embedded software, IoT, process control and sensor conditioning. It is also a customer oriented company performing its activities from the product idea stage to the production and assembly stage. ARTI, with its staff having domain expertise, is a leading company with a wide range of customers throughout Turkey and has been providing quality design, production, technical support, repair and maintenance solutions for electronic systems.

Producing devices designed for military land, air and marine applications in accordance with customer needs, ARTI presents prototype and mass production of such devices to customers together with all of their production and design documentation. All devices produced or designed by ARTI, from military-type ethernet switches to high-power-density converters, are verified via tests that are adapted to the military standards required by the integrated unit and are used in challenging conditions required

by military applications.

Since its foundation, ARTI has established working principles for identifying and meeting customer needs and requirements and has taken many steps toward developing them. As a consequence it has documented its business philosophy with the international standard TS EN ISO 9001 Quality Management System, and it is amongst ASELSAN's approved subcontractors for Hardware Design.

ARTI designs are concentrated in the field of power electronics and ARTI can provide analog and digital design and simulation



support in a wide range including power electronics converters, power distribution, software, IoT, process control, signalization and sensor conditioning. It also conducts the mechanical design and analysis of all devices it has produced.

ARTI demonstrates its electronic design capability with designs made on the basis of card and component.

Below are some of ARTI's electronic design capabilities:

- › Hierarchical schematic design,
- › Complex and high-density wiring harness design,
- › Multi-layer and high density, impedance 3D printed circuit board design

ARTI develops the software of its smart devices designed



for a variety of military and industrial applications by using the embedded Linux operating system for ARM core processors or for DSPs and MCUs of Texas Instruments and Microchip companies.

For use in military applications, ARTI designs user interface software and its graphics to either run on a computer or an embedded processor.

ARTI creates project-specific mechanical designs in Catia V5 PML and Solidworks Professional environments. The mechanic designs of which are shaped according to customer requirements and MIL-STD-810 standard tests, are developed in a way that also provide EMC shielding for electronic devices within.

Mass production and R&D oriented production are carried out by certified technicians trained in IPC in a production environment that conforms to ESD standards.

Complex and high-density wiring production, which is compatible with the tests in MIL-STD-810 standards and meets EMC requirements, is performed by experienced ARTI personnel at ARTI production facilities.

Critical printed circuit board components and printed circuit boards produced for R&D purposes are assembled in ARTI production facilities whereas for mass production, ARTI partners with PCB assembly companies and supervises them for the assembly of its printed circuit boards.



ARTI has designed and produced many Power Distribution and Control Units that succeeded in various EMC tests defined in the MIL-STD-461 standard and environmental tests defined in the MIL-STD-810 standard.

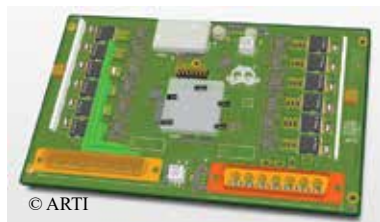
The Power Distribution and Control Units of which ARTI has the design and production capability can be categorized under two types in accordance to their user requirements. The possible features of the units according to its type are summarized in the table below.

ARTI has full competence in the design and production of rectifiers, DC / DC converters, inverters and motor drives used in military and industrial applications in the discipline of power electronics. Most of ARTI products are used in the defense industry and designed and manufactured in accordance with MIL STD 810G, MIL-STD-704, MIL-STD-1275 and other related electrical and environmental standards.

Capabilities of ARTI regarding power electronics application are summarized below:

- › AC / DC Power Supplies (100W-20kW)
- › AC / DC Battery Chargers
- › DC / DC Converters
- › DC / AC Inverters (50W-100kW 50-400Hz)
- › Component Based SMPS Design
- › High Frequency Planar Transformer and Inductor Design (Planar Magnetics)
- › MHz Band Switching Frequency Possessing Converters Enabled by the use of SiC-GaN/FET
- › Converter Design with Maximum Efficiency > 99%
- › Analog and Digital Closed-Loop Control Ability
- › BLDC-PMSM-Asynchronous Motor Drive Design (Torque-Speed-Position control)

The functional verification activities verifying that the



© ARTI

Available PDU Options	Robust Smart PDU	Enhanced Smart PDU
Industrial/Military Temperature Range (-40°C ~ +85°C)	✓	✓
Enhanced Temperature Range (-55°C ~ +125°C)	✓	✗
Commercial Temperature Range (-32°C ~ +85°C)	✓	✓
Operating System	✗	✓ Embedded Linux
Required Time Ready to Operate	< 1 second	10 to 20 seconds due to Operating System booting time
Simple to Intensive Built-in Self-Test	✓	✓
Touch Screen	✗	✓
Monitoring of Digital/Analog Data (e.g. input/output voltage/current levels, faults)	✓	✓
Remote Monitoring via Ethernet	✓	✓
Local Monitoring via LCD Screen	✗	✓
Boot loader (Firmware upgrading via maintenance connector without the need to reach the board itself from the JTAG interface)	✓ via Serial Port	✓ via Ethernet
Watchdog Timer	✓	✓
Logging and Log Rotating	✓ Limited to memory	✓ Embedded Linux (syslog and logrotate services)
Multithreaded Application	✗	✓ Embedded Linux
Solid-State Switching Board Connectivity	✓	✓
Isolated/Non isolated PIO	✓	✓
Processing of Wide-variety of Sensors	✓	✓
Hardware/Software Enabled Elapsed Time Counting	✓	✓
Configurable Software Options without Source Code Revisions	✓	✓

produced devices fully meet customer requirements are performed at ARTI facilities through custom test software, test cards and other test equipment all of which are designed and produced by ARTI.

The products designed and produced for functioning under challenging conditions are tested functionally by ARTI and verified through EMC tests in the MIL-STD-461 standard and environmental tests in the MIL-STD-810 standard that ARTI is now highly experienced with due

to the verification process of many of its products.

The design, production and analysis of the test wiring and fixtures required for the tests are provided by the experienced staff of ARTI.

ARTI has taken part in various projects of major companies such as Aselsan, Roketsan and TÜBİTAK Space in the defense industry up to date and also has carried out joint studies with various companies such as TCDD, TÜLOMSAŞ, Demir Export and Park Termik.



Amphenol Turkey / Middle East Office, Coordinating Regional Activities, Marketing and Sales for Amphenol Facilities

In this exclusive Defence Turkey interview, Amphenol Turkey & Middle East General Manager, Mr. Hakan Saraçoğlu discusses the company's activities in Turkey and the importance of connector selection for long-term project success. The Company designs, manufactures and markets electrical, electronic and fiber optic connectors, coaxial and flat-ribbon cables, sensors, antennas and interconnect systems

Defence Turkey: Firstly, could you please share with us information about Amphenol's core capabilities and products?

Amphenol is one of the world's largest manufacturers of interconnect products in all sectors within 6 continents, 110 operations, over 240 factories and over 10 million part numbers (Connectors, Cables, Antennas, Sensors).

Amphenol has a flexible structure and specializes in interconnect products and is constantly developing in this direction. Amphenol's biggest strength is the employees who embrace the company as their own. We also have a long lasting 86-year history and solid experience built on a strong foundation and R&D studies.

Since 1932, we have continued to grow both organically and through acquisitions that expand our product range.

Our local and global distributors operate both by holding stocks of standard products and providing technical support for projects. In order to provide better service to our customers, we continue our efforts to assign sector and product-based distributors.

Defence Turkey: How do you asses Amphenol's position in 2017? What are your goals for 2018?

Amphenol grew 8% globally in 2017. As Turkey and the Middle East office, we grew 18%, and we would like to continue to grow by 15-20% in 2018.

We address our improvement goals according to customer requests, expectations and needs. In other words, we plan to accomplish our own goals by supporting our customers to achieve their goals.

Particularly in the military and aerospace sector, our position in the region is growing rapidly. I think that the Eurasia Airshow exhibition, which is being held for the first time this year, will contribute very significantly to future growth.

We will attend the show as a participant and we have also invited our colleagues from our related factories to attend. We invite all guests to our Eurasia Airshow stand# 318A.

Defence Turkey: What are your R&D activities? Could you



please inform us about your new technologies and new products?

Our R&D departments work closely on a variety of projects with the R&D departments of the world's leading companies (Airbus, Boeing, Sikorsky, Lockheed Martin, Aselsan, TAI etc.). According to the requests of our customers' emerging demands, new connector designs are constantly being developed and manufactured. We continue to increase our diversity by focusing on technological and innovative product ranges.

Our facilities which operate in different markets have very strong R&D departments that develop products according to the regional expectations and based on their product ranges. One of our strengths that gives us an advantage is that we can offer a wide range of new and technological product solutions within the framework of our customers' requests and applications.

Our marketing team in Turkey is composed of experienced engineers. We provide technical support and seminars to our customers so that they can choose the right product in a short period of time. We are dedicated to sharing the developments in the connector market and our future technologies that are newly developed in accordance with the specific needs of our customers.

Defence Turkey: Could you please discuss the company's structure, mission and the key areas of Amphenol Turkey?

Team work with related facilities is very important for increased

efficiency. Balanced & healthy growth in all markets is one of our main targets in our region.

We contribute by sharing new technologies, practices and sectoral developments on connector products with both R&D engineers (customers) and related facilities within Amphenol.

We also facilitate technical support and coordination amongst our customers and distributors with our facilities. As Amphenol has so many facilities and a large product range, addressing the requests and resolving problems in the quickest and best way possible is one of our key roles.

Defence Turkey: Turkey is one of the significant markets for Amphenol, demonstrated through successful collaboration with Turkish firms in the past and with present activities. Could you please enlighten us about your activities in Turkey and ongoing programs in the defense, aerospace, civil aviation and naval sectors?

We have been conducting our current business as well as design work for many years with our local firms like Aselsan, TAI, Roketsan, etc. Our collaboration has continued to increase over the years in various projects (A400M, T129 "Atak" Attack helicopter, "Anka" UAV, T625 Multi-Role Helicopter, Ground control units...).

Amphenol maintains its number one position globally with a total revenue of \$1.1 billion from the Military and Aerospace Market all over the world. We strive to build on our position as the global leader,

to be number one not only in the military and aerospace market, but also in all markets with our service, experience and product variety.

Defence Turkey: How do you appraise collaboration with Turkish defense and aerospace companies?

We continue to increase our services and sales by improving ourselves according to regional demands and needs with each passing day.

We have professional and strong connections with our military and aerospace customers. We arrange regular visits to assess our customers' needs, complaints and challenges. Based on the customer feedback and our assessment, we work with our AMPHENOL facilities to create long-lasting solutions by sharing information and best practices with our colleagues and all levels of management where needed. Our colleagues from related facilities are regularly travelling to give trainings on their expertise. We are doing our very best to provide



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the most appropriate solutions toward resolving problems and addressing needs.

Looking back on the years 2004 to 2017 in the military and aerospace market, our total sales grew 16 fold in Turkey and 30 fold in our region. We consider this growth as a great result showing successful collaboration with our stakeholders. We rest assured continuing to improve our services through the feedback we receive from our customers.

Defence Turkey: Could you please inform us on your future plans for Turkey to expand your presence in the market?

As I mentioned before, Amphenol constantly develops its own designs by working with its main customers based on the product ranges that it finds lacking in its own field, or it acquires new companies which will complement

the missing product ranges in this respect.

Personally, my greatest dream and desire is to establish an Amphenol facility in Turkey for local production which I believe would be a great opportunity and very beneficial both the company itself and our country.

Defence Turkey: Finally, would you like to add some final thoughts and give a message to our readers?

It may not be feasible for our customers to reach the right products or the right factories quickly amongst a large number of Amphenol facilities; their requirements can vary according to their application and market.

We would like to facilitate the connector design for our customers by being their single point of contact that supports them during all stages of their project. Military and aviation products are special products with

challenging specs based on various applications. Also, engineers should keep in mind that production lead times for military and aviation products can be long.

We always talk about the importance of connector selection for long-term project success. Because no matter how well the performance of the designed electronic devices is, you can only perform as well as the performance of the interconnecting element.

Experienced R&D engineers are aware of this detail and they always start working on the connector selection at the beginning of their project.

As the Turkey and Middle East office, we would like to mention that we are pleased to be providing the necessary support to R&D projects that contribute to the development of our country and to all our customers; they can always reach out to us without hesitation ■



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SAHA Istanbul Cluster – Championing Integration of Existing Regional Potential to Produce Cutting-Edge Technology

SAHA Istanbul Defense and Aerospace Cluster is the leader of its regional industry focusing on the goal to eliminate foreign dependency in the Defense Industry and in civil aviation. In an effort to get to know SAHA Istanbul better and to catch up with their activities, focus and future targets, Defence Turkey Magazine conducted the following interview with Mr. İlhami Keleş, the General Secretary of SAHA Istanbul Defense and Aerospace Cluster

Defence Turkey: Could you please tell us how SAHA Istanbul originated? What was your starting point?

The very first movement of this formation was our Dear President Recep Tayyip Erdoğan's call at TÜSIAD's 40th Assembly General held on 21 January 2010 where he was then the Prime Minister as he uttered the words "I am looking for a brave fellow to manufacture a unique automobile". Upon these words, the ITO Industry Expertise Committee concluded that "aircraft production" which contains high added value is a crucial issue and a primary area in which to focus.

Defence Turkey: Why "Aircraft Production" when speaking of a unique automobile?

The most distinctive features of this industry are its ability to benefit from the latest novelties of science. Technology and its products are examples of the most advanced product and production technologies. Therefore, this industry is amongst the leading sectors that play a driving role in the development of the countries' technological infrastructure.

Besides, the countries successful in aviation and space industries are capable of generating full-scale system solutions as a result of their competencies in these branches of industry. The wide range of their products and their domination in the design technologies of these products are observed as well.

From this point of view, at the end of 2011, the ITO Industry Expertise Committee initiated a study where one hundred and fifty people from the leading companies of the industry, THY Technic primarily, participated in "Indigenous Civil Aircraft Production" that last for 1.5 years, and over 20 meetings and workshops were held to this end. Finally, in January 2013, the report on "The Strategic Analysis and Road Map on the Civil Indigenous Aircraft Production in Turkey" was completed and submitted to the Executive Board of ITO.

A significant amount of resources have been allocated for the import of spare parts by over three hundred companies such as THY Technic, the rising company Turkish Airlines and HABOM which provides maintenance services for the airline companies. When these factors were considered, the motivation for this study increased.

Where the initial idea was to build the aerospace industry cluster

and thus manufacture the parts of our indigenous aircraft through this initiation, former General Manager of Turkish Technic, our Undersecretary for Defense Industries Prof. İsmail Demir who is the former CEO of Turkish Technic and is quite familiar with the production capacity of the North Marmara Industry emphasized that the Naval Forces Command's projects were being conducted in Istanbul and its hinterland and stressed on Istanbul's superiority in metal, chemicals and composite technologies and advised that Defense should be added to the scope of the activities, SAHA Istanbul Defense and Aerospace Cluster was formed on 17 March 2015 by 27 founding members with the great support of the Undersecretariat for Defense Industries (SSM), Istanbul Chamber of Commerce (ITO), Istanbul Chamber of Industry (ISO) and Teknopark Istanbul management in order to function within the North Marmara hinterland starting from Sakarya spreading towards Edirne, including Yalova and to activate this grand potential we own through common synergy.

Defence Turkey: Which factors required the establishment of SAHA Istanbul?

Spanning a 150,000,000 m2 Industrial Area of which 100,000,000 m2 fall within the city limits of Istanbul, 51 Industry Regions and 55 shipyards within the region of SAHA Istanbul out of 72 existing shipyards in Turkey, North Marmara Region produces over 50% of Turkey's economy and tax revenues. There are over 100,000 industrial facilities located within North Marmara hinterland that contains 65,000 companies registered to ITO, 18,000 companies registered to ISO and 8,000 companies registered to DTO. There are approximately 2,000,000 people employed by this industry in this region and 1,500,000 of them are located in Istanbul.

A passenger capacity of one hundred and fifty million will be added to the existing capacity of seventy million passengers when the third airport is completed, and the overall capacity will reach two hundred million. As a natural consequence of this development, Istanbul will become the civil aviation center of Asia, Africa and Europe when the ground services, air cargo capacity and maintenance services capacity are provided to over 300 domestic and foreign airline companies by companies such as Turkish Technic, THY HABOM and My Technic.

When the Project is completed in this region, Teknopark Istanbul will extend to an indoor area of 980,000 m2 within a 2.5 million m2 area. The Valley of Informatics, which will be completed in four stages, will be established over an area of 3 million m2, technology sites owned by fifty-four universities and certain major universities and an installed capacity of an eco-system will exist.

The producer companies within the SAHA Istanbul region are outward oriented, exporting companies competing with other companies around the world. Their technological infrastructure, know-how and encouragement indicate that there is nothing our companies cannot achieve if the willpower, resources and markets are put forth. Then again, they remain quite distant to utilize their technological and infrastructural accumulations in the defense and aerospace industries. The lack of information on these industries and requirements is one of the reasons of their avoidance while not being familiar with the capital city Ankara and its bureaucracy and not daring to struggle with the potential obstacles and bureaucratic barriers are among other reasons. Informing and motivating these companies while removing these grey areas and rendering them available to manufacture products and systems required by the defense, aviation and space industries by contributing to their battle against bureaucratic obstacles remain as our primary tasks. Therefore, this geography that produces 54% of Turkey's industrial production should assume more active roles in the effort to abolish foreign dependency in critical technologies.

Defence Turkey: Which activities are being conducted in line with the establishment purposes of SAHA Istanbul?

By benefiting from the existing potential in its region, we aim to create synergy by building cooperation between the regional companies for the development and manufacturing of cutting-edge technological products. As a result, we will be increasing the rate of domestic participation in national defense industry projects and aerospace. We have to achieve 100% of indigenouslyness in certain critical projects.

Moreover, releasing global brands by developing special products that require high technology, therefore creating a global competitive advantage and achieving an

alliance in governmental, private or international tenders remain as the main functions of SAHA Istanbul.

Establishing and developing cooperation between our members and governmental institutions, universities, research institutes, NGOs, development agencies and international support centers, contributing to the establishment of the Test and Certification Centers with international accreditation, and execution of the common legal and industrial property rights services are also among our activities.

The lack of a capability inventory is the greatest deficiency of the industry located in the Istanbul hinterland. In order to fulfil this requirement, we will launch the EYDEP Project with the SSM in the Marmara Region. We assess that with the help of this Project, our companies will be better recognized, assignment of certain companies to certain projects will be enabled and governmental incentives will also form an essential element of support.

With the EYDEP Project, we wish to render our companies either the supplier of one another or the solution partners of each other by directing them towards each other. Their familiarity of each other's capabilities and thus their establishment of cooperation will provide them with significant advantages. We, as the SAHA Istanbul cluster, continue to successfully conduct activities that will enable companies to become more integrated with defense industry projects and affiliate more with each other.

By gathering the companies that are the main contractors in the defense industry with our members and enabling bilateral negotiations, we contribute to the process by creating alternatives to procurements that they make from foreign countries or their domestic purchases and thus increase the rate of domestic participation at the same time. For instance, we arranged for Roketsan to conduct negotiations with 253 companies. We held bilateral negotiations by gathering our members together with our companies such as Aselsan, TAI, THYSSENKRUPP, Boeing, BMC, Otokar and FNSS as well. Soon, we will hold a similar activity with our companies at Gölcük Shipyard where our submarine projects are being carried out.

The SAHA Istanbul fair which we will hold for the first time at IFM on 12 – 15 September 2018 will be a vital opportunity for us in this respect. The

major foreign platform manufacturers will be at the event and we will be able to meet them.

Moreover, we are striving to create awareness in the areas of defense, aviation and space by attending seminars, symposiums and discussions. We also strive to conduct joint activities through national and international foundations or institutions that conduct similar activities with us by becoming their members to carry these efforts into the international arena, realizing technology transfers and drawing direct investments to our country.

Defence Turkey: What is SAHA Istanbul's target regarding domestic industry?

The way to achieve sustainable welfare, stability, a strong economy and deterrent armed forces for a country is through owning technology and the eco-system to develop it constantly. At this point, the wealthy country and developed country concepts are separated. When you have oil drilled underground and you sell it then you will have lots of money. This will make you a rich country. You may build luxurious buildings with this money and live in wealth. Furthermore, you may purchase the most modern weapon systems in the world. None of these turn you into a great country. They would only make your country a huge market. In order to become a major country, you need to own companies generating global brand technologies, dominate this technology and therefore dominating the future. Today, oil is a determinative and precious source of energy, yet when the technological developments reach more affordable and effective sources of energy, then the oil rich countries will have to face the ugly truth. For this reason, instead of a country buying and using technology, we have to be the country that produces it, at least we have to build upon the worldwide trends in certain areas.

We believe that, our government's responsibility at this point should be defining the areas in which we are capable of catching global technology trends and identifying the competent companies, even adopting positive discrimination in support of these companies just like South Korea and elevating them with globally competitive technological and financial infrastructure and therefore creating global brands.

The task falling upon the government is to identify the areas in which to focus and with whom to collaborate by taking technological

accumulation, potential and the existing level of the country into consideration while regarding the progress of the world's technology.

The defense and aerospace industries that utilize the most advanced technologies are relatively luckier than other industries in making these types of decisions. When we examine the world, we see that the countries that reached certain points in the defense industry are also capable of making use of these competencies in other industries as well. Because these industries include a wide variety and are composed of electronics, composite, food, metals, chemicals and automotive that require high technology in almost all areas. The case is quite similar in aviation. Therefore, these industries have always been the favorite of these countries that achieved a certain level of success in technology or countries aiming to reach that point.

If we wish to exist as a major country in the future, we also have to focus on these issues and avoid wasting our energy and limited resources by building proper industrial strategies. We have great examples of achievements ahead, so we do not need to 'reinvent the wheel.'

As SAHA Istanbul, we wish to develop our country's component, sub-component and system development capabilities and its product range in this area. To this end, we have to minimize the foreign dependency of our platform building companies in respect to the sub-systems and systems that they import. Finding a spot in the global markets for the developed sub-systems and systems will be much easier than parts production during further stages. We are grouping the companies to develop such capability. The air-conditioning group that we built with TAI is a great example of this. A sub-system will be revealed resulting from a consortium composed of six companies, under the leadership of one company. As the required know-how is owned, this consortium will be part of all future design of domestic manned air vehicles as well.

In this way, while we develop our companies' culture of collaboration, we will also free our main contractor companies from the need to run after parts and conduct logistics activities with hundreds of companies to this end.

Defence Turkey: The necessity of effective cooperation between

University and Industry is being uttered with every platform. Yet we observe that this cooperation fails to achieve the desired level in practical terms. We know that you have activities within this scope. Which activities will SAHA Istanbul carry out in order to fulfil this mission?

Our universities should have three main functions. The first of these tasks is the most neglected task and perhaps the most critical one; it is training scientists. Our talented youth capable of becoming scientists are being educated with an average curriculum and become employed in businesses struggling to earn their keep. The lucky ones seize the opportunity to even receive Nobel awards with the title of an American scientist of Turkish origin and we could only be proud of them from a distance. There are 16 million young people in Germany with a population of 82 million whereas Turkey with a population of 78 million has 33 million young people. In theory, our potential to raise scientists should be approximately double of Germany's. Yet the reality speaks for itself. We fail to provide our children with great capabilities in an atmosphere where they can focus only in science, free from the curriculum, exams, and free themselves from the worries of receiving a diploma and the wage to afford their lives. We only give those receiving degrees in mathematics and physics Olympics in high schools a few more points in the university entrance exams. We unfortunately fail to sufficiently benefit from the most basic resource feeding the universities. Therefore, we only get the chance to transfer the science developed by others to Turkey only by the rate they allow and merely when they allow this transfer. This is utilized by a limited number of people.

The Basic Sciences Research Foundation was established to eliminate this problem. From SAHA Istanbul, I, our Accountant Member of the Board Mr. Hakan Altınay and our Founding 1st Term Board Member Prof. Metin Yerebakan remain at the Board of Trustees of this Foundation. We will endeavor to turn our children with superior scientific talents into scientists. If achieved, this will be turned into a University of Basic Applied Sciences supported with special legislation.

The second main function of the universities is to generate technology with private industry. Yet, the technology is built over the basic

sciences I mentioned previously. We already lag-behind due to the insufficiency in basic sciences. Still, our universities lack the mechanisms capable of developing technology through open science. Unfortunately, the academician's activities in such areas are perceived as their utilization of the academy for their individual benefit and therefore are banned. The best academician is regarded as the one avoiding industry, who utters fancy sentences in articles and books and at seminars and symposiums while attending classes on occasion. While the academicians keen on cooperating with industry, those who intend to produce are marginalized from this mechanism. To this end, we are initiating an implementation to overcome this perception and to gather our academicians together with industry. We will match our academicians with relevant industries with our universities such as Istanbul Technical University and Gebze University and make this effort official. In order to assure the university's generation of technology with industry and launch our companies' projects into life at the universities we made a protocol enabling our universities to operate as R&D centers. Taking your projects or ideas, we will be realizing them with you together with the facilities of universities by building a legal infrastructure with intellectual property rights. We aim for the evolution into a technology development process from the product development process, in time.

Within this scope, our industrialists need to adopt the culture of collaboration with universities as well. Our main concern in this respect are intellectual property rights. Perhaps, certain improvements should be made in the legal infrastructure to this end, eliminating grey areas and ambiguity. This will reinforce the trust and promote relations.

Additionally, the financial gains received through such activities would motivate our academicians further. The required legislative regulations in this area have been launched and some of them are already effective.

The third task of our universities in respect to industry is the development of professional, technical and academic training and certification training to support the human resources required by the industry. As SAHA Istanbul, we signed a protocol with Istanbul

Technical University, Marmara University and Gebze Technical University. Thereafter, protocols will be signed with our universities having their own companies within our cluster such as Sabancı University, Özyeğin University, Gedik University, from Anatolia Akdeniz University and Firat University that are close to the industry in areas where they are competent. The availability of graduate and PhD programs linked with the projects conducted by our companies, certification training, enabling internship opportunities for the students at our companies and activities such as joint career days will be conducted. Our companies will benefit from the laboratories of these universities under more convenient conditions. We promote training researchers with entrepreneurial spirits equipped with information, technology and innovative perspectives, supporting the Device/ Equipment and Technology Manufacturers of Defense, Aviation and Space Industries in all their activities including the promotion, marketing and branding as our tasks as well.

We assigned a project to the Istanbul Development Agency to build a Design and Analysis Center for our SMEs at Teknopark Istanbul with our Marmara University and we expect positive results.

Defence Turkey: Finally, what are your views and comments on Defense and Aerospace industries?

The defense industry has become directly linked to the independence of a country. It is one of the dominant parameters of foreign policy. Being a technology producing country is now among the prerequisites of being active in this area. We must build the defense of the country through the defense systems we develop with the technology that we produce and equip our armed forces with national weapons. To achieving this, both our bureaucracy and our platform manufacturing companies must be sensitive to this case, it is of vital importance. Politics, national industry and the press are quite interested in indigenous systems. We expect the same level of motivation from our government and the decision makers of our foundation companies as well. Even in this atmosphere where the Third World War is in question, our industrialists' struggle to develop or sell indigenous products to our armed forces, yet their failure to overcome certain barriers is a critical issue we need to focus on ■

OKIS Acceptance Tests Successfully Accomplished by Meteksan Defense

With the written statement made by Meteksan Defense, it was announced that the acceptance tests were completed successfully for the Automatic Take-Off and Landing System (OKIS), which was developed nationally for the first time, providing precise position information by using radar technology in automatic take-off and landing systems of Unmanned Aerial Vehicles.

All tests of the OKIS airborne segment integrated into the ANKA UAV platform and the OKIS ground segment located on the side of the runway were successfully performed. Under GPS-denied environment in a radius of 10 to 15 kilometers, the OKIS airborne segment and the ground segment located on the side of the runway provide enable safe take-off and landing of the UAV systems by communicating robustly without being subject to jammers.

The system was integrated into the tactical class Bayraktar TB2 platform in December 2017 and communication between the OKIS airborne segment and the OKIS ground segment was provided from 12 km.

Following these tests, the

end-product that became ready for mass production is scheduled to be displayed at the Eurasia Air Show.

OKIS systems will provide important capabilities to MALE and Tactical Class UAV systems and the studies to include them in the inventory of the Turkish Armed Forces are ongoing.

Automatic Take-off and Landing System (OKIS)

The Automatic Take-off and Landing System (OKIS) is a mono pulse transponder tracking radar which is used for take-off and landing phases of the Unmanned Aerial Vehicles (UAVs). OKIS consists of two subsystems; the OKIS Airborne Segment and the OKIS Ground Segment. The OKIS Airborne Segment is a transponder with its antenna set installed on the UAVs and the OKIS Ground Segment is mono pulse interrogator radar installed in the sideline of the runway. The OKIS Airborne Segment is small in size and weight and could be used in almost any type of UAV without experiencing any significant capacity degradation of payload capacity.

The OKIS Ground Segment



provides a safe and precise take-off/landing by feeding accurate UAV's 3D position information (range, bearing, elevation) to the Ground Control Station (GCS).

OKIS has strong mobility with its two-man lift feature and easy and quick installation and de-installation feature. OKIS has a robust design specific for battlefield conditions and mission reliability requirements and it facilitates ground operators in take-off and landing UAVs on both ends of the runways.

Due to the unprotected nature of GPS signals against various jamming techniques, OKIS provides a reliable solution especially in wartime for the automatic take-off and landing processes of UAVs.



TSSK - Teknokent Defense Industry Cluster

TSSK will participate the Eurasia Airshow, which is the first and the biggest civil aviation airshow in Turkish history, with its 20 members. TSSK companies will demonstrate their capabilities and technologies and also will have an opportunity to widen their business network with many international and domestic participants. Below are the exhibitor TSSK cluster companies and their related activity areas;

AEROTIM Engineering has been active in the flight simulator business for over 10 years, their work ranges from project management and consultancy for software development of sub-systems, high-fidelity flight dynamic model development and the full integration of FNPT and FFS-type EASA Level D simulators.

ANOVA Engineering provides products and services for various industries such as defense, automotive, white goods energy, construction and machine manufacturing.

ARGOSAI is an experienced multi-disciplined team that take part in many technology projects such as aircraft design, image process and artificial intelligence development, neural networks and deep learning.

ARTI ELEKTRONİK is a design company providing customer-oriented service from concept to product which is specialized in various areas such as, industrial electronic design, electronic card design, mechanical design, software design etc.

Aselsan is Turkey's largest defense electronics company whose capability/product portfolio comprises communication and information technologies, radar and electronic warfare, electro-optics, avionics, unmanned systems, land, naval and weapon systems, air defense and missile systems, command and control systems, transportation, security, traffic, automation and medical systems.

BITES Aerospace & Defense is a global software development company at the forefront of



simulation training solutions for military and civilian organizations. The company is developing high fidelity, cost-effective technologies for tactical military training and applied game-based technologies to a range of breakthrough, military-specific training and simulation software products.

Havelsan develops indigenous systems for domestic and foreign military, public and private sector and provides smart solutions based on today's state-of-the-art technologies.

INFOTRON has a products and services portfolio that includes a wide range of 3D high-tech solutions used in design and production processes.

ICterra is a global software engineering company that combines software development experience with technology expertise and proven methodologies to provide innovative solutions to customers across multiple industries.

MANUS has safely entrusted more than thirty, 3-4-5 axis machining post process documents with their proven development, organizational achievements and professional skills.

Meteksan Defence specialized in the field of communication systems, platform simulators, sensor systems and underwater acoustic systems.

MILSOFT is a system integration and software development company with business in the defense industry.

NERO Industry, with its national development, mass production, test and qualification procedure in three basic product groups, provides complete basic solutions in; power systems, fire extinguishing and explosion suppression systems, chemical biological radiological nuclear filtration systems and applications.

ROKETSAN Missile Industries, founded by the decision of the Defense Industries Executive Committee to lead the rocket and missile programs, providing reliable system solutions with proven performance for domestic and foreign users.

SDT Space & Defence Technologies Inc. has been developing indigenous software, hardware and integrated solutions for Defence, Space and Aviation.

Turkish Aerospace Industries, Inc. (TAI) is specialized in the design, development, modernization, manufacturing, integration and life cycle support of integrated aerospace systems, from fixed and rotary wing air platforms to UAVs and satellites.

TEKSIS have engaged in many projects, which have been carried out for the purpose of producing commercial fuel cells, integrated systems including PEM Fuel Cells, Electrolysers, Wind and Solar Energy Sources, Storage tanks, piping, control units including hardware and software.

Bursa is Strengthening its Supplier Position in the Defense Industry

Bursa companies that have been participating in the projects of large-scaled domestic and international institutions in the defense and aerospace industry are in a position to meet 75% of Turkey's defense industry needs through their infrastructure in the manufacturing industry. Noting that Ankara is the center of the defense industry as per the decisions made by the government, the Bursa Chamber of Commerce and Industry (BTSO) Aerospace & Defense Council and Clustering President Mr. Mustafa Hatipoğlu said that Bursa will become a strong supplier in the sector. Underlining that Ankara should not regard Bursa as performing only in the automotive sector, Mr. Hatipoğlu emphasized that as the city, they prefer to advance also in the defense and aviation/aerospace industry.

Pointing out that the leading producers in the sector are impressed by the infrastructure in Bursa, Mr. Mustafa Hatipoğlu, "We want to increase the effectiveness of the city in different sectors. The export figures in the field of defense and aviation/aerospace are still below our expectations, but the activities and efforts made by the companies in this field are promising for the defense industry exports of the city. While the exports of Bursa companies in the sector reached \$1 million in 2015 and reached \$7.2 million in 2016, an increase of 615 percent, there was only an increase of 6 percent in 2017 and exports amounted to \$7.6 million. Accordingly, we have targeted markets such as Kazakhstan, Azerbaijan, Middle East and Malaysia".

"20 projects were introduced at the workshops held in 2017"

Mr. Mustafa Hatipoğlu pointed out that many Bursa companies

are involved in projects with domestic and foreign organizations such as SSM, TAI, TEI, Roketsan, Havelsan, Aselsan, THY Teknik, Airbus and Boeing. He noted that in order to increase defense industry production in the city, they organized the Light Armored Vehicles Workshop and the Uludağ Indigenous Product Projects Workshop.

Mr. Hatipoğlu: "In particular, at the Uludağ Indigenous Product Projects Workshop, nearly 20 projects were introduced, from the trainer aircraft project to unmanned land vehicle projects, the general aviation and Tactical Unmanned Aerial Vehicle engine development project, the unmanned air cargo aircraft, the 3D printer efforts for the defense industry to future military garments. Some of the projects became candidates to receive R&D support from the Undersecretariat for Defense Industries (SSM), the SSTEK partnership support and some co-operations were achieved."

"Meetings realized with major industrial companies will increase efficiency"

Stating that TAI which has been carrying out projects such as "Hürkuş" new generation trainer aircraft, T120 "Atak" helicopter, national combat aircraft and ANKA came together with cluster member companies in Bursa in January, he continued, "Then the 'Havelsan Days' event was organized. At the end of 2017, the 'Roketsan Days' event and the 'Supplier Days' event of the Land Forces Command Electro Optic Systems Maintenance Center Directorate were organized and the procurement officials of Aselsan came together with Bursa companies."

Conveying that this year participation in 3 international fairs together with B2B negotiations

will be realized, Mr. Mustafa Hatipoğlu said, "Today the Bursa Space Aviation/Aerospace Defense Cluster, founded by the Bursa companies under the roof of BTSO, has reached 78 members. Cluster members of 27 companies became entitled to obtain support from the Ministry of Economy in 2014 within the scope of the Communiqué regarding Support for the Development of International Competition (URGE)".

Noting that the cluster received the status of an association in 2015 and was named the Bursa Space Aviation/Aerospace Defense Cluster Association, Mr. Hatipoğlu said, "Bursa companies are now at a level that can meet 75% of Turkey's defense industry needs through their qualified manpower, production technology, and infrastructure in the fields of automotive main and sub-industry, machinery industry, textiles and technical textiles".

"The number of cluster companies receiving URGE support will increase"

Emphasizing that the strong infrastructure provides a significant advantage for the development of space, aviation and defense sectors in Bursa, Mr. Mustafa Hatipoğlu stated that the cluster activities are gathered under five main topics such as land, air, naval defense projects, civil aviation, space, sportive aviation and general aviation. Mr. Hatipoğlu emphasized that the number of companies supported within the scope of URGE within the cluster will increase this year and continued, "The achievements gained by the cluster and the emphasis made on national and domestic production as a state policy have increased demands for cluster studies".

Saudi Arabian Military Industries and Boeing Form Joint Venture Partnership Targeting 55% Localization

With revenues to exceed \$22 billion and 6,000 jobs by 2030. Partnership to provide sustainment services for fixed- and rotary-wing military aircraft of KSA military fleet

In line with Saudi Arabia's Vision 2030 and following the announcement of HRH Prince Mohammed bin Salman bin Abdulaziz, Crown Prince, Deputy Chairman of the Council of Ministers and Minister of Defense, to localize 50% of the total military spending by 2030, Saudi Arabian Military Industries (SAMI) and Boeing have signed a Memorandum of Agreement (MoA) to develop a new joint venture (JV) aiming to localize more than 55% of the MRO services for fixed and rotary-wing military aircraft in Saudi Arabia on 30th March. The agreement will also transfer technology to install weaponry on these aircraft as well as localize the supply chain for spare parts in the Kingdom.

The signing ceremony came in conjunction with HRH Prince Mohammed bin Salman's visit to Seattle, which included an official visit and tour of Boeing's aircraft manufacturing facilities. The agreement was signed by H.E. Ahmed Al-Khateeb, Chairman of SAMI, and Dennis Muilenburg, Chairman, President, and CEO of Boeing, at Boeing's commercial manufacturing facility in Everett, Wash. The ceremony also included a comprehensive visit to the manufacturing facilities of Boeing, featuring a detailed explanation of the company's operations.

Commenting on this important milestone, H.E. Ahmed Al-Khateeb, Chairman of SAMI, said, "Boeing has a long-standing commitment to Saudi Arabia, and is extremely keen on expanding its footprint in the country. Inspired by the vision of HRH Prince Mohammed bin Salman, SAMI, on the other hand, is exploring all collaborative opportunities to build a strong autonomous military industries ecosystem in the Kingdom."



The joint venture agreement will provide sustainment services for fixed- and rotary-wing military aircraft of the KSA military fleet and will be the sole provider of these services for all military aviation platforms of the KSA military fleet, strengthening the Kingdom's defense capabilities and enhancing its deterrent potential.

"We deeply appreciate the trust that the Kingdom of Saudi Arabia in general, and HRH Prince Mohammed bin Salman personally, are placing in Boeing to help deliver Vision 2030 with this new joint venture," said Dennis Muilenburg, Boeing Chairman, President, and CEO. "Our relationship with the Kingdom dates back more than 70 years, and we look forward to continuing our successful partnership in support of the Kingdom's national security and aerospace industry needs."

The MoA will further solidify the enduring relationship between Boeing and Saudi Arabia and result in the development of local research, design, engineering, manufacturing, and MRO abilities. The JV will continuously improve performance and growth, upgrade the readiness of and increase confidence in the Saudi military fleet, enhance maintenance capabilities, and reduce support costs throughout the fleet's life. In addition, the agreement will create

6,000 jobs and training opportunities for Saudi youth, support local content, improve Saudization levels in the industry, and assist towards achieving the ambitious Vision 2030 plan.

Dr. Andreas Schwer, CEO of SAMI, added, "The significance of the MoA, which is signed today, will enable SAMI and Boeing to play a key role in leading and laying the foundational framework for Saudi's defense sector industrialization, in line with the goals of the Kingdom's National Transformation Program and Vision 2030. In addition to local sustainment capabilities, the inevitable partnership between the two companies could explore the creation of intellectual property as well."

Once the MoA is operational, the joint venture will provide a foundation for future platform sales and for expanding Boeing's presence in the Kingdom to support market growth for both commercial and defense programs.

Leanne Caret, President and CEO, Boeing Defense, Space and Security added, "With this local capability dedicated to sustaining all U.S.-made defense platforms, we can better serve our customers and support the Kingdom's goals of localization and economic growth."

Leonardo to Showcase Unique Products and Capabilities at Eurasia Air Show

Leonardo will attend the inaugural edition of the Eurasia Air Show, which will showcase key international technologies in commercial and military aviation to Antalya for the first time.

With its broad portfolio of products and services, Leonardo can respond to almost all civil and military requirements in the air sector, from fixed and rotary-wing aircraft that are ready for all kinds of missions – and their related training and logistics services – to state-of-the-art avionics and sensors, as well as systems and networks for air traffic management and control.

In Antalya, Leonardo will exhibit its C-27J, the most advanced multi-mission airlifter available on the market today. Thanks to the widest cabin in its category, unrivalled manoeuvrability, the interoperability with heavier airlifters like the C-130 and the A400M, and with a climb rate that allows the aircraft to reach 10,000 ft in approximately 5 minutes, the C-27J has the capacity to carry significant loads and still access small, soft, narrow runways even in snowy and sandy weather conditions. The



C-27J can be equipped with the latest technologies including Night Vision Goggles (NVG), ballistic protection system, a Defensive Aids Sub System (DASS) and an air to air refuelling “Probe & Drogue” system. The aircraft can perform missions including troop transport, Command, Control, Communication & Surveillance

(C3-ISR), firefighting, maritime pollution dispersion, VIP/government transport, and more.

In Turkey, Leonardo will also be marketing its AW101 helicopter. In service from the Arctic to the Antarctic, the AW101 delivers high performance in hot and cold environments, day and night and in all weather conditions. This





three-engine medium/heavy military multirole helicopter can perform a wide range of land and maritime missions. In the naval domain, these include anti-submarine warfare, anti-surface warfare, helicopter early warning, utility, amphibious support, surveillance and patrol, long range search and rescue. The 16-ton AW101 is the most advanced helicopter in its class, capable of autonomous operations and featuring state-of-the-art flight and mission avionics and equipment. Its large cabin has the capacity to host up to 30 fully-equipped troops, it can be equipped with advanced self-protection systems for outstanding survivability, and its twin-engine cruise speed capability provides extended range and endurance for operations.

Guests at the Eurasia Airshow will also be able to see Leonardo's Miysis DIRCM, which provides effective protection against widely used MANPADS in an environment where flare technology has limitations against advanced and emerging threats. Leonardo's Miysis DIRCM system has been extensively tested with successful results and defines and demonstrates the level of protection needed for all airborne platforms. Because it is designed and manufactured in the UK, Miysis DIRCM is readily exportable around the world.

Visitors flying to Antalya will be served by Leonardo's technology as soon as they approach the International Airport. Antalya, famous among tourists from all over the world for its wonderful seaside, is home to a top-tier air traffic control system supplied by Leonardo, ensuring safe and effective management of flights. The Air Traffic Control (ATC) center is part of a wider system, which includes ATC centers and radars developed by Leonardo under the Turkish SMART (Systematic Modernization of ATM Resources Turkey) program. Deployed in Ankara, with a backup in Istanbul, the SMART system supports air traffic management operations in 50 of Turkey's airspace sectors (both upper and lower) located in Istanbul, Izmir, Ercan, Dalaman and Bodrum, and Antalya itself. The system connects more than 20 remote control towers encompassing over 600 ATC-related workstations, with a one-of-a-kind resilient system architecture ■

SB Havacılık (SBAIR) is the New Airbus Helicopter Distributor and Service Center in Turkey

Airbus Helicopters has appointed SB Havacılık A.Ş. (SBAIR) to be its new distributor and Service Center in Turkey. The Istanbul based company will represent the European manufacturer in Turkey and promote its civil product line.

SBAIR was established in 2017 by Mr. Ercüment Bayegan (Bayegan Group) and Mr. Mehmet Yüksel Hocaoğlu (Swan Aviation). Bayegan Group was established in the 1940s, operating in the petroleum and petrochemical industry with 27 offices worldwide. Mr. Hocaoğlu has over 25 years of aviation experience and over 15 years of sales and management experience in business aviation market through Swan Aviation.

SBAIR will act as a distributor and provide after-sales services in the areas of maintenance, logistics support and training support in Turkey for the Airbus civil helicopter fleet.

Mr. Mickaël Peru, Airbus Helicopters' head of Sales for Eastern EU & CIS, said: "We are pleased that we have found an experienced partner in Turkey, who will use local expertise to serve our current and future customers in the best way possible, thus bringing a new dynamic in our approach to the market, particularly the proximity of support and services to our customers."

Mr. Mehmet Yüksel Hocaoğlu, Vice Chairman of SB Havacılık A.Ş., said: "The technologically advanced helicopters made by Airbus have a great potential in Turkey for commercial air transport as well as private and business aviation."

With a share of 50 percent of the global market in 2017 for civil and parapublic helicopters (turbine helicopters >5 seats), Airbus is the market leader in this segment. "We see a huge opportunity for growth in Turkey and our new distributor SB Havacılık A.Ş. will help to further develop the use of helicopters in the country by being closer to the customers", said Mr. Mickaël Peru.

NASA Selects Lockheed Martin Skunk Works to Build X-Plane

Supersonic commercial travel is on the horizon. On 3th April, NASA awarded Lockheed Martin Skunk Works a contract to design, build and flight test the Low-Boom Flight Demonstrator, an X-plane designed to make supersonic passenger air travel a reality.

"It is super exciting to be back designing and flying X-planes at this scale," said Jaiwon Shin, NASA's associate administrator for aeronautics. "Our long tradition of solving the technical barriers of supersonic flight to benefit everyone continues."

Lockheed Martin Skunk Works will build a full-scale experimental aircraft, known as an X-plane, of its preliminary design developed under NASA's Quiet Supersonic Technology (QueSST) effort. The X-plane will help NASA establish an acceptable commercial supersonic noise standard to overturn current regulations banning commercial supersonic travel over land.

"We're honored to continue our partnership with NASA to enable a new generation of supersonic travel," said Peter Iosifidis, Low-Boom Flight Demonstrator program manager, Lockheed Martin Skunk Works. "We look forward to applying the extensive work completed under QueSST to the design, build and flight test of the X-plane, providing NASA with a demonstrator to make supersonic commercial travel possible for passengers around the globe."

Lockheed Martin Skunk Works and NASA have partnered for more than a decade to enable the next generation of commercial supersonic aircraft. NASA awarded Lockheed Martin Skunk Works a contract in February 2016 for the preliminary design of the supersonic X-plane flight demonstrator.

The aircraft will be built at the Lockheed Martin Skunk Works facility in Palmdale, California, and will conduct its first flight in 2021.



Double A400M Delivery Launches Celebrations of 20th Anniversary of OCCAR Convention Signature

Airbus has for the first time formally delivered two A400M new generation airlifters to two different nations in one day. The company handed over the aircraft on 20 March to the European Organization for Joint Armament Cooperation (OCCAR), in charge of the management of the A400M Program, representing Germany and France – at a ceremony in Seville, Spain. OCCAR Director Arturo Alfonso-Meirino said: "It is a great pleasure to see two of the leading OCCAR nations receiving these superb aircraft on the same day in a year when the organization is itself celebrating the 20th anniversary of the signature of its Convention. This is testimony to the effective work performed by OCCAR's A400M team over many years in managing this exceptionally complex program." These latest deliveries were the 60th and 61st A400Ms to be handed over and take the German and French fleets to 18 and 14 aircraft respectively.



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