

GLOBAL BUSINESS REPORTS

INDUSTRY EXPLORATIONS



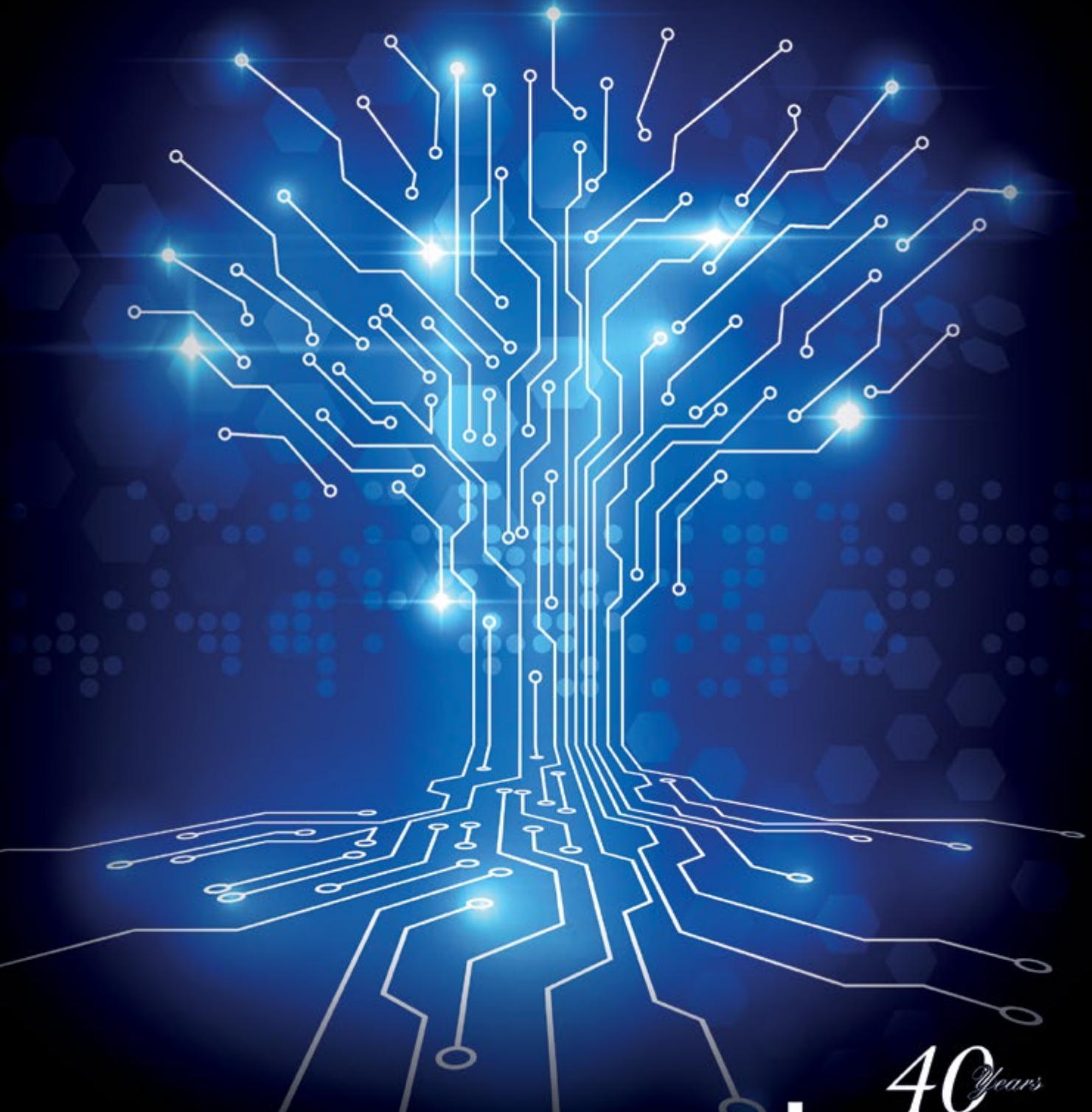
TURKEY AEROSPACE & DEFENSE 2016



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Platforms - Clusters - Multinationals - Sub-Tier Suppliers*

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Distinguished GBR Readers,



Since the inception of the Undersecretariat for Defense Industries 30 years ago, significant steps have been taken to achieve the goals of having the Turkish armed forces equipped with modern systems and technologies and promoting the development of the Turkish defense industry.

In the last decade alone, the aerospace and defense (A&D) sector's total turnover quadrupled, while exports have increased fivefold, reaching \$5.1 billion and \$1.65 billion in 2014, respectively. The industry's investment in research and development (R&D) reached almost \$1 billion in 2014. The total workforce in the A&D industry reached 30,000 personnel, of which 30% are engineers. Even more remarkable, Turkey is now at the stage of offering its own platforms for both the local market and to international allies, and has commenced a series of follow up local programs.

Although this progress has been achieved under the circumstances of a healthy and consistent political environment and in parallel with sustained growth in the Turkish economy, the proportion of expenditure for defense in the national budget and as a percentage of Turkey's GDP has been stable.

With the help of the national, multinational and joint defense industry projects that have been undertaken in Turkey by the undersecretariat, the defense industry has become a highly capable community comprising large-scale main contractors, numerous sub-system manufacturers, small- and medium-sized enterprises, R&D companies who are involved in high-tech, niche areas, research institutes, and universities. Thus, we can proudly say that we have a constantly growing and ambitious defense sector that looks ahead to achieving even greater things.

Yours Sincerely,

A handwritten signature in blue ink, reading "İsmail Demir".

Prof. Dr. İsmail Demir
Undersecretary
Undersecretariat for Defense Industries,
Republic of Turkey (SSM)



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This research has been conducted by Irina Negoita, Neha Ghanshamdas, Edward Bars, and

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Exclusive Interviews

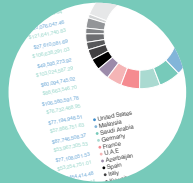
Leaders from both the private and public sector delve into the nuances and nascent developments that are shaping the industry.



10, 14, 23, 30, 46, and many more

Editorial Content

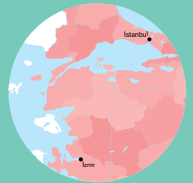
Global Business Reports' journalists provide on-the-ground analysis of the trends that are shaping Turkey's aerospace and defense industry.



8, 11, 20, 28, 44, 54

Quantitative Data and Maps

Quantitative data help readers better understand the position of Turkey, especially relative to its global competitors.



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Supply Chain

Over 2,000 SMEs are operating in Turkey's aerospace and defense sector. GBR goes in-depth to describe how these companies are supporting manufacturers.



54-61

Future Outlook

Aerospace and defense is at the cutting edge of technology and risk. Turkey's established and emerging players share their visions for the future of the industry.



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INTRODUCING THE AEROSPACE & DEFENSE INDUSTRY IN TURKEY



“The Turkish aerospace and defense industry produces roughly 60% of its own needs for defense, while 40% comes from international sources. TAFF aims to improve the share of local production within the next five years, including supporting Roketsan and Havelsan, so that they can become one of the top 100 global companies like Aselsan and TAI.”

- Orhan Akbaş,
Lieutenant General (Retired), General Manager,
Turkish Armed Forces Foundation (TAFF)

THE CEASELESS SEARCH FOR SECURITY

A Brief Political and Economic Overview of Turkey



Since the beginning of the Cold War, Turkey has been a bulwark of stability in a dangerous and fracturing world. The United States began in 1947 to provide aid to Turkey under the Truman Doctrine, as part of its grand strategy to contain the Soviet Union and guard against Soviet encroachment on the Middle East and the Mediterranean. The end of the Cold War, however, did not reduce Turkey's importance. As the United States opened a much wider presence in the Middle East starting with the Persian Gulf War in 1990, Turkey remained a critical ally for regional security. Today, Turkey's neighborhood is perhaps more dangerous than ever before, as fires emanate from Syria and Iraq throughout the Middle East while a revanchist Russia flexes its military muscles.

It is unclear what consequences Syria will have on the region, but Turkey's role as a stabilizing force in the Middle East is unlikely to change. Turkey stands out in a region of weak states because of its territorial size, large and industrious population, and military strength. The latter is predicated upon having a robust and technologically advanced aerospace and defense industry. By many economic indicators, Turkey has made impressive strides since the Justice and Development Party (AKP) came to power in 2002. On the back of 5% average annual real GDP growth from 2002 to 2012, Turkey is now the world's 17th largest

TURKEY VISION 2023 - Selected National Targets for 2023 by Sector

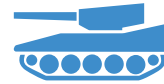


ECONOMY

- Become **Top-10** Economy in World
- Achieve **\$500 billion** in Exports
- Grow GDP to **\$2.064 trillion**
- Grow GDP Per Capita to **\$25,076**

DEFENSE

Develop national rifle, cannon, tank, helicopter, fighter aircraft

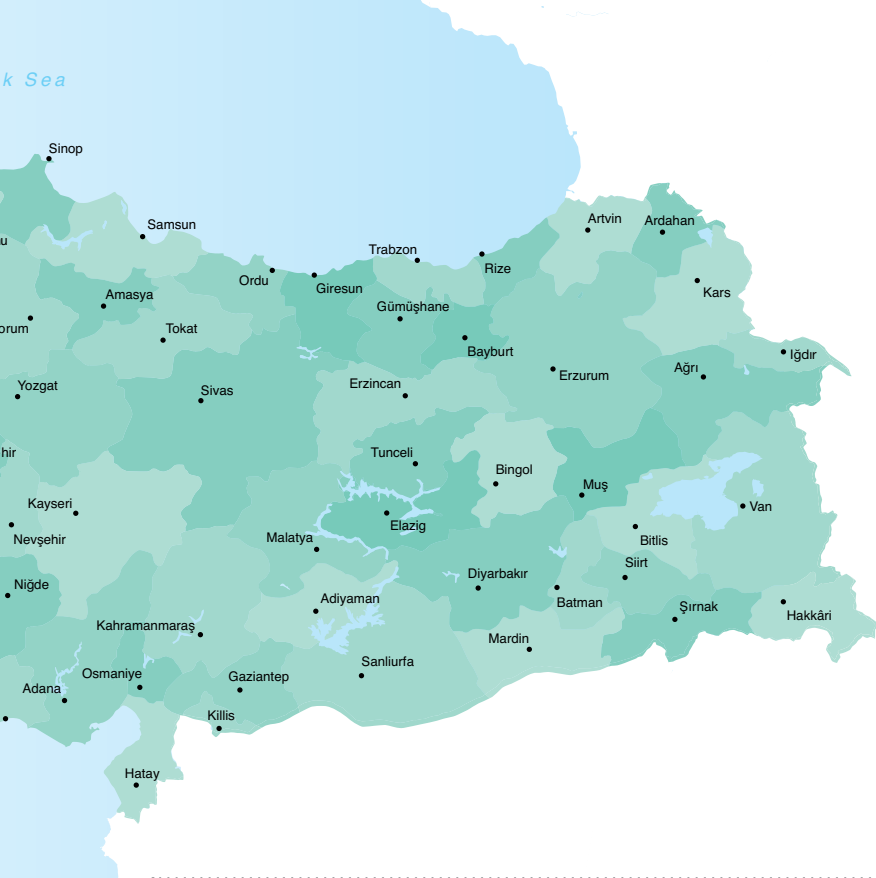


AVIATION

- Domestically produce plane
- Establish two aviation maintenance and training centers
- Establish Turkish Space Institute

economy, according to the IMF, and has ambitions to reach the top ten by 2023, the centennial of the Republic. While growth slowed during the global financial crisis in 2008, Turkey was not exposed to the same pressures as Europe and the United States and vaulted out of 2009 into 9.2% and 8.8% growth in 2010 and 2011, respectively. Yet economic growth has slowed considerably from 2013 to 2015, and currency depreciation is eroding the profitability of many industries. Russian-imposed sanctions on the country after it shot down a

Russian fighter plane in November 2015 are hurting Turkey's exports and tourism figures. More than other countries, Turkey relies on foreign investment to fuel its economy and maintain its current account deficit, and policymakers have always had to perform a careful balancing act to manage the country's fiscal balances, but today's pressures make a challenging situation even more difficult. Low oil and gas prices have provided some relief. Politically, the AKP has maintained control over power since 2002. The party's power



TURKEY AT A GLANCE

Source: CIA World Factbook

Population: 79,414,269 (July 2015 est.)
Land Area: 783,562 sq km
Official Languages: Turkish
Capital: Ankara
Chief of State: Recep Tayyip Erdogan (since August 2014)
Head of Government: Prime Minister Ahmet Davutoğlu (since August 2014)
Growth Domestic Product: \$1.515 trillion (2014 est.)
Growth Rate: 2.9% (2014 est.)
GDP per Capita: \$19,700 (2014 est.)
Economic Sector Breakdown: agriculture: 8.1%, industry: 27.6%, services: 67.6% (2014 est.)
Exports: \$168.9 billion (2014 est.): apparel, foodstuffs, textiles, metal manufactures, transport equipment.
Imports: \$232.5 billion (2014 est.): machinery, chemicals, semi-finished goods, fuels, transport equipment.
Major International Trade Partners: Germany, Russia, China, Iran, Iraq, United States, Italy, France

\$19,700

GDP PER CAPITA
2014 est.

Source: CIA World Factbook

derives from its popular support from the middle and lower classes, which have struggled in the past to reap the benefits of the state under past regimes that were installed by military coups. In no sector has the average Turk benefitted more than in health, as access to insurance and coverage has greatly expanded.

At the heart of the AKP's popularity is its charismatic leader, Recep Tayyip Erdoğan. Erdoğan served as Prime Minister from 2003 until 2014 and was elected President in August 2014. His former Foreign Minister, Ahmet Davutoğlu, became Prime Minister. Although no longer in the constitutionally most powerful office, Erdoğan is still the party's leader.

The AKP met its first political stumbling block during the June 2015 parliamentary elections, as the Kurdish Peoples' Demo-

cratic Party (HDP) crossed the requisite 10% threshold to enter the Parliament. The other established opposition parties – the Republican People's Party (CHP) and Nationalist Movement Party (MHP) – also maintained enough support to block the AKP's from retaining a parliamentary majority. The failure to form a government thereafter, however, stalled the political process. Meanwhile, a new round of violence broke out between the Turkish military and the Kurdish terrorist group PKK that has plunged the southeastern part of the country into a war zone. Where previously Erdoğan championed a set of reforms that would make the state more inclusive for its Kurdish minority, such measures will have to wait until later.

Snap elections in November 2015 produced the status quo ante, with the AKP

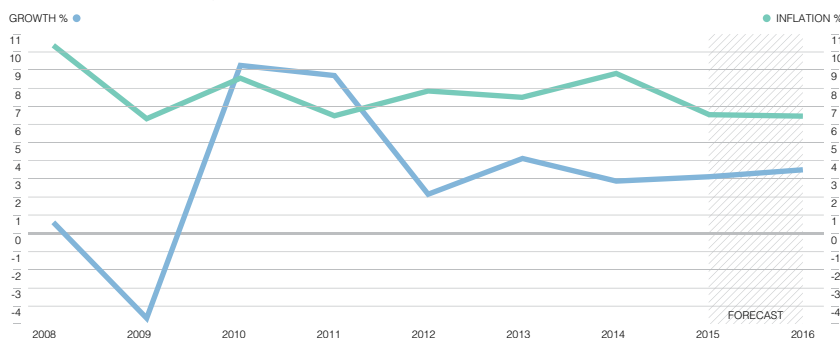
increasing its percentage of the vote from 40.8% in June to 49.5% in November and regaining enough seats to form a government on its own. Though there are growing concerns about the authoritarian drift of the party, the election provided stability and markets reacted positively, with the Turkish lira gaining almost 10% in value against the U.S. dollar. The lira, however, returned to the 3-to-1 rate in 2016.

Foreign policy provides the most uncertainty, as the so-called Islamic State is operating next door in Syria, Kurdish militants in Syria are providing a safe zone for the PKK in Turkey, and Russia is now involved in the Syrian morass. The next several years are likely to be challenging ones for policymakers. In a dangerous neighborhood, Turkey's search for security is ceaseless.

The aerospace and defense industry is at the heart of Turkey's domestic and foreign policy, and the AKP remains committed to its growth and development by offering incentives to bolster its indigenous original equipment manufacturers and suppliers. Turkey takes a great deal of pride in its military, and the growth of Turkish Airlines over the past decade is nothing short of remarkable. As the following pages will reveal, Turkey is investing in its aerospace and defense industry, and is already a regional leader. Only time will tell if it can become the global player that it aspires to.

TURKEY GROWTH VS. INFLATION (2008 TO 2016)

Source: World Bank, International Monetary Fund





Dr. Celal Sami Tüfekçi

Deputy Undersecretary, Industry Services
**UNDERSECRETARIAT FOR
 DEFENSE INDUSTRIES,
 REPUBLIC OF TURKEY (SSM)**

●●● What is SSM's current strategy to support Turkey's defense industry?

SSM has put forth a plan outlining its strategy until 2016, but it is not static, and has changed repeatedly over the course of our development. SSM is currently working on the development of new strategies, and the geopolitical events that are occurring around Turkey are also affecting our work. We have identified niche areas of importance and are turning our attention to cyber security, border control, and unmanned systems. SSM has established, and is very keen to grow, an important new department called Cyber Security.

In recent years offset requirements have increased to upwards of 50% for large defense projects. What are current offset requirements and how are they being allocated?

When offset requirements and regulations were put in place roughly 15 years ago, they

were seen as roadblocks for main contractors. Once SSM imposed these regulations on the industry, the defense sector began to reshape, and Turkish manufacturers started developing. The driving force behind Turkey's success in defense industrialization is regulation. In general, Turkey contributes approximately 70% of domestic value-added content in each contract. However, there are projects for which SSM does not want domestic value added because they are short either in budget or in time. Other than that, almost every project comes with industrialization requirements.

Over the last 10 years, many small companies have grown into medium-sized companies, conducting business with foreign suppliers directly, even without SSM contracts. Initially SSM required foreign contractors to work with these companies, resulting in the formation of longstanding relationships. Today, foreign contractors are happy to work with these companies, like ALP Aviation in Eskisehir for example, which works with the international helicopter giant Sikorsky.

How is this strategy reflected in the development of tier-one, tier-two and tier-three companies? Are you keen to grow the number of tier-ones?

Of course we would like to have more tier-one companies, which will materialize in five to 10 years. In this timeframe, we will grow Turkey's very large companies due to the number of projects coming up, including the Hürkus trainer aircraft, ATAK helicopter, and unmanned systems (on which TAI, Baykar, and Vestel have already progressed well). A large number of frameworks have been built in Turkey with minimal dependency on the foreign market. Turkey has achieved a great deal thus far, especially given external limitations, such as export restrictions from larger countries.

There are of course key elements including power generation and the drivetrain, for which Turkey is still externally dependent. Nevertheless, we support research and development (R&D) to overcome these deficits, including engine-development programs for both land and air platforms and transmission and power transmission projects. Today Turkey is placing great importance on producing subsystems. When we began this journey we saw everything as platforms. As we started to create platforms indigenously, we realized the importance of subsystem technology, and about establishing a dedicated department

for subsystems one year ago. With this new department, Turkey can start indigenously designing subsystems like power transmission and generation for different platforms.

Do offsets play a role in R&D programs and the development of subsystems?

Offsets are helping, but Turkey needs technology to build subsystems, which requires a greater focus on R&D. SSM's R&D department, or technology management department, is launching many R&D projects. A portion of the offsets that companies owe SSM is realized through SAYP, a program for educating and training researchers in the defense industry. Export-offset requirements are deducted from the money that companies spend on these projects. Many universities have already signed onto the program, promoting university involvement in defense projects and enabling the growth of independent researchers. Another channel that SSM utilizes is the technology-acquisition requirement, through which approximately 2% of contracts have to be dedicated to building new technologies.

While Turkey is strengthening its military capabilities at home, the government has set its 2023 export target at \$25 billion. How likely is the realization of such a target?

Turkey has set large and ambitious goals, which can be achieved through momentum. At present we have good momentum and support from the government to launch projects, hence the large number of ambitious projects such as the T-FX fighter, which costs billions of dollars. Our advantage is the momentum that we have gained in recent years, which will help us to encourage members across the industry, including the smaller companies that we are focusing on. We are continuously strategizing with small players so that they can evolve into more technologically competent companies. When smaller companies work on subsystem parts for a larger platform they learn about the platform and the technology, and can produce technology faster than big companies. Big companies are integrators, whereas small companies create technological value. SSM wants companies to gain technological advantages so that they can quickly elevate their revenues. It is still a question of whether or not we will achieve this export level but pressure from all directions is compelling us to achieve many things. •

ON THE EDGE OF TOMORROW

Turkey's Aerospace and Defense Sector

“One day, humankind will walk in the sky without airplanes, visit planets and, maybe, send us news from the moon... Our duty is to ensure that we are not left far behind the West.” Mustafa Kemal Atatürk spoke these words in 1936 to inspire the people of the fledgling nation of Turkey. Turkey's aerospace and defense (A&D) sector has since progressed, but remains far from its ambitious 2023 goal to become one of the world's top ten defense producers.

The resurgence of Turkey's A&D industry began in the 1980s at a time when the country was heavily dependent on foreign countries for critical technologies. An arms embargo prompted the government to rethink its policies and develop an independent A&D industry that could reduce Turkey's dependence on foreign technology. The guiding strategy was to increase the share of local content in production, which was to be achieved by encouraging technology transfer, strategically allocating offset requirements—or portions of projects that required domestic development—to major projects, and procuring large A&D projects to strengthen the local knowledge base.

Yet even with the robust development of A&D companies across the northwest of the country, Turkey's industry has a long way to go to realize its goals. The majority of the industry is driven by large defense projects such as the Utility Helicopter, the A400M, the HÜRKUŞ trainer, the Anka unmanned aerial vehicle (UAV), and indigenous fighter and commercial jet programs. While generous defense spending will ensure the continuation of these projects, their timelines and commercial viability are questionable because many critical technologies have yet to be developed to a level of sophistication that can reduce dependence on foreign manufacturers.

Meanwhile, export-licensing difficulties have forced companies to focus on selling their products to the Middle East, Central Asia, and Southeast Asia. As a result, Turkey exports its

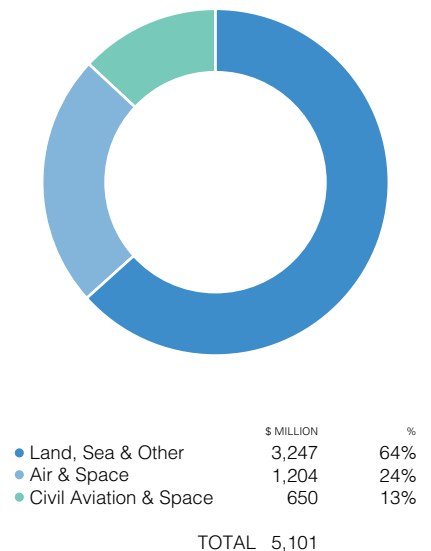
TURKISH AEROSPACE & DEFENSE INDUSTRY TURNOVER (\$ BILLION)



defense products to countries such as Azerbaijan, Pakistan, and Malaysia and maintains strong ties with Middle Eastern countries, which will continue to serve as fertile markets. While exports have been steadily increasing since the year 2000—totaling \$1.65 billion in 2014—the numbers remain far from the government's lofty 2023 target of \$25 billion. Approximately two-thirds of Turkey's A&D companies are concentrated in the capital city of Ankara, where many of the small- and medium-sized enterprises (SMEs), large defense companies, and software development firms are located. Turkey's software development firms are the most dynamic and primarily operate out of Middle East Technical University Technology Park, ODTÜ TEKNOKENT, and belong to the Teknokent Defense Industry Cluster (TSSK). Companies within TSSK have a strong export focus, with products that range from surveillance analytics and flight simulation to command-and-control systems. This range is partly due to the cluster's role in fos-

TURKISH DEFENSE INDUSTRY TURNOVER BY SECTOR, 2014 (\$ MILLION)

Source: SaSaD



tering collaboration, which is generally lacking in Turkey.

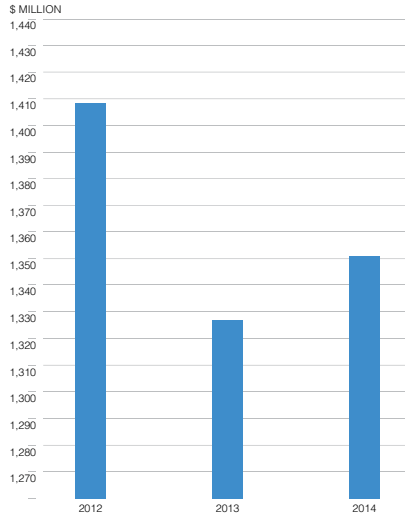
“It is important to facilitate synergies between those conducting research and development (R&D) at universities, companies conducting R&D, and large-scale firms outside the science and technology parks. Hence TSSK’s main purpose is to increase synergies between various players of all sizes between the university and industry,” said TSSK’s chairman of the board, Fatih Ünal.

Outside of the technology cluster there are major aerospace platform-and-missile systems producers as well as software and electronics developers, the majority of which are managed by the Turkish Armed Forces Foundation. The industry’s largest players include Turkish Aerospace Industries, Inc. (TAI), Aselsan, Roketsan, and Havelsan.

Outside of Ankara, the northwestern city of Eskisehir is home to a specialized cluster, Eskisehir Aviation Cluster (ESAC), whose member companies focus largely on engine and helicopter-related production and design. In addition to a long industrial history and specialized university programs for aeronautics, Eskisehir hosts both Tusaş Engine Industries, Inc. (TEI), a major engine producer and joint venture with General Electric (GE), and Alp Aviation, a joint venture with Sikorsky. An additional technology center and aviation hub is located in Istanbul, where several software development firms are located in Teknopark Istanbul, one of Turkey’s two technology development zones with an A&D focus. Turkey’s fourth center for A&D production is Izmir, where

TURKISH AEROSPACE & DEFENSE IMPORTS, 2014 (\$ MILLION)

Source: SaSaD

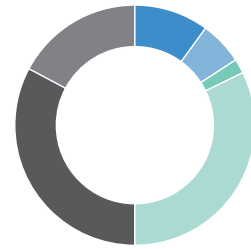


Fokker Elmo and Lisi Aerospace are located. The majority of companies in Izmir are SMEs in the Ege and Izmir Free Zones that work in the fields of fasteners, electrical systems, and fuel tanks.

The overall composition of the industry is both bottom- and top-heavy, with limited development of medium-sized companies. The growth of stronger supporting companies has been hampered by the low volume and high specialization typical of A&D products. Yet the knowledge SMEs gain from working on defense-related aerospace products should allow them to more easily start contracting with foreign firms like Airbus and Boeing for civil aviation projects. Key to growing the number

TURKISH AEROSPACE & DEFENSE IMPORTS BY SECTOR, 2014 (\$ MILLION)

Source: SaSaD



	\$ MILLION	%
Land Vehicles	134	10%
Sea Vessels	87	6%
IT	25	2%
Aerospace	428	32%
Electrical and Electronics	445	33%
Other	232	17%

TOTAL 1,351

of medium-sized enterprises will be the development of subsystems and critical technologies. Managing partner at Herdem Attorneys at Law Şafak Herdem agrees: “To achieve further consolidation, effective guidance from both the government and businesses is required, and is only possible through offsets.”

The lack of specialization in these areas is being addressed by the Undersecretariat for Defense Industries (SSM), an institution established to draft defense policies. Today SSM is working to implement policies to correct this imbalance, including research support and offset requirements.

Regardless of these challenges Turkey remains active in avionics and software, with

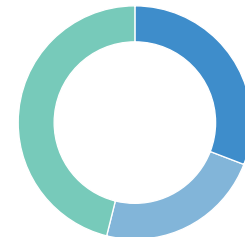
TURKISH AEROSPACE & DEFENSE EXPORTS (\$ MILLION)

Source: SSM



TURKEY FOREIGN SALES BY REGION AEROSPACE & DEFENSE, 2014 (\$ MILLION)

Source: SaSaD

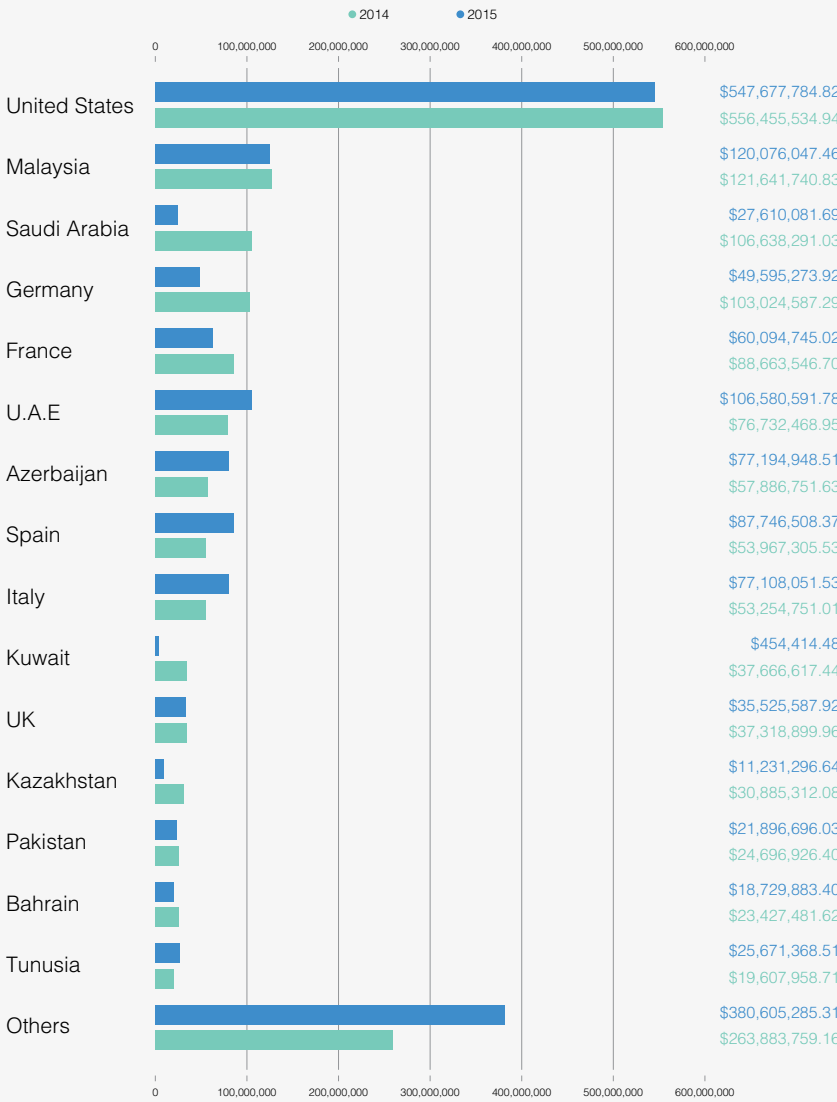


	\$ MILLION	%
United States	581	31%
Europe	418	23%
Other	856	46%

TOTAL 1,855

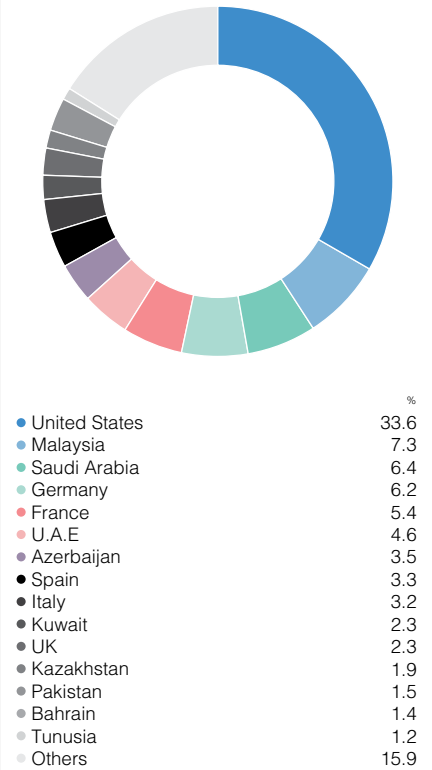
TOTAL TURKEY AEROSPACE & DEFENSE SECTOR EXPORTS BY COUNTRY, 2014-2015

Source: SSM.



TOTAL TURKEY AEROSPACE & DEFENSE SECTOR EXPORTS BY COUNTRY, 2015

Source: SSM.



\$1.656 billion

Turkey Aerospace and Defense Total Exports 2015

its technology companies leading the industry forward. Companies such as BITES, for example, are investing in new technologies like augmented reality (AR) for the future of the industry. “Military operations are becoming increasingly diverse in their nature. Many of the new and more demanding military requirements have specifically driven development of augmented reality systems and we see that as a big growth area. AR technology is also used by the defense platform manufacturers in their advanced factories and assembly lines. For example, Lockheed Martin engineers are using augmented reality glasses and educational software that provide real-time visual content during the assembly of F-35 Aircraft,” said Ihsan Yusuf Akbuğa, international business development director at BITES. Despite its growing defense sector, presently

there is little civil aviation platform development within Turkey. This is due in part to World Trade Organization restrictions that prohibit offsets from being applied in this area, unlike in the defense industry. Nonetheless, driven by GDP growth, Turkey’s passenger, international, and overflight markets are improving. These trends are driving airport construction and increasing aircraft purchases. Turkish Airlines, for example, recently placed an order with Airbus for the purchase of 117 new planes. While domestic platforms such as the regional jet are still in early phases of development, Turkish A&D companies are beginning to work in civil aviation as well. Consequently, flight simulation, composite materials machining, and engine-part production are finding their foothold among Turkey’s civil aviation exports. More work will need to

be done in order to grow the local civil aviation sector, which today represents just 13% of total A&D turnover. But as defense production grows, so will the number of civil applications for technologies and products. Turkey’s A&D sector is on track to grow within the next five to ten years, largely thanks to government support. Major projects like the ATAK and general utility helicopters, indigenous fighter planes, Anka UAV, and radar design and production will drive the industry forward and allow it to develop key competencies in critical technology and import-dependent areas. Furthermore, a targeted export strategy that focuses on developing markets should offset current restrictions on exports by larger countries. If Turkey’s aerospace industry can overcome its current obstacles, its future will truly be in the skies. •



Orhan Akbaş

●●● Lieutenant General (Retired), General Manager
TURKISH ARMED FORCES FOUNDATION (TAFF)

●●● **The Turkish Armed Forces Foundation is the largest actor in Turkey’s defense industry besides the government. What is the history of the organization and what role in the market does it play today?**

After the 1964 Cyprus crisis, the need for Turkish-made military equipment became a national priority. By 1974 an embargo by the United States and other allies on military exports to Turkey following the Cyprus Peace Operation accentuated this need. The overreliance on foreign equipment showed a key strategic gap, leading Turkey to consider developing an independent defense industry. In order to achieve these goals Turkish Land, Naval and Air Forces Support Foundations were formed in 1960s and 1970s with the donations of Turkish people that established companies for the production of defense equipment, such as Aselsan, TAI, Roketsan and Havelsan. In 1987, Turkish Land, Naval and Air Forces Support Foundations were integrated,

and the Turkish Armed Forces Foundation (TAFF) was established. The main mission of the foundation is to enhance the warfare capability of the Turkish Armed Forces through the development of projects in new defense-industry fields and through the procurement of equipment using the financial and moral support of Turkish citizens. But this foundation works like other companies and is not a government organization as the foundation’s income comes from the Turkish people. Given the nature of the industry, however, the Board of Trustees is comprised of the Minister of National Defense, who is also the chairman, the Deputy Chief of Turkish General Staff, the Undersecretary of the Ministry of National Defense, and the Undersecretary for Defense Industries.

To give a brief overview, Aselsan specializes in defense electronics, TAI is a leading company in aeronautics, Roketsan develops missile and rocket systems, and Havelsan focuses on command and control systems and other defense software.

The foundation works as a group of companies, six of which are subsidiaries, and eight of which are affiliates. In 2014 the Turkish Armed Forces Foundation subsidiaries comprised 45% of net sales, 56% of exports, 52% of research and development (R&D) expenditures, and 39% of all employees for the entire Turkish defense and aerospace industry. Additionally, these companies currently export 25 products to 45 countries. TAFF subsidiary companies are leaders in Turkish Defense Industry and worldwide. The Istanbul Chamber of Industry (ISO) 500 2014 listing, which rated Turkish companies by net sales, ranked Aselsan, TAI, Roketsan, Havelsan 33rd, 50th, 128th, 244th respectively. Furthermore, according to a Defense News Top 100 listing, which also ranked companies globally based on net sales, they found Aselsan and TAI to be ranked 62nd and 78th respectively.

The defense industry often has sophisticated requirements, especially in aerospace where safety, reliability, and flexibility for products are a major concern. What is the R&D environment like for Turkish Armed Forces Foundation companies?

Research and innovation is a primary focus for TAFF, roughly 7% of our yearly income is allocated for research and development. Aselsan, TAI, Roketsan and Havelsan have

a total of four facilities in technology development zones and ten R&D centers, where they employ total of 4,890 R&D engineers. Moreover, Aselsan, TAI and Roketsan were chosen as the best R&D centers by the Ministry of Science, Industry and Technology in 2013. Our vision is to establish five research and development centers in Ankara and another 15 smaller centers within our companies.

TAFF group companies accounted for 52% of all R&D expenditure in the industry in 2014. TAFF currently monitors and keeps tabs on the R&D projects of its subsidiaries. The foundation recently improved its innovation and R&D organization by establishing a new section responsible for following global technological advances, preventing redundancies between TAFF’s subsidiaries, and providing coordination with institutions such as Turkish General Staff, TÜBİTAK, and universities.

TAFF’s strategic management is critical for setting objectives for performance. What is your strategic vision for the future?

TAFF has a five-year strategic plan to create a systematic approach for the future, manage our subsidiaries by setting objectives and evaluating their performance, and promote cooperation as the leader of TAFF group companies.

The Turkish defense and aerospace industry produces roughly 60% of its own needs for defense, while 40% comes from international sources. TAFF aims to improve the share of local production within the next five years, including supporting Roketsan and Havelsan, so that they can become one of the top 100 global companies like Aselsan and TAI. In addition, we also want to provide logistics support for our products and systems internationally as well as our current products used by the Turkish Armed Forces.

Part of the strategic focus is on aerospace, command and control systems, and simulators. There are also several exciting projects under development, particularly the helicopter and fighter jet projects, which will extend for the next 10 to 15 years. Energy efficiency and production will be another major focus, especially to meet the needs of the Turkish Armed Forces. The industry is growing, and the foundation plans to expand current export levels of around \$1 billion to \$5 billion by 2023. •



Latif Aral Aliş

Chairman

DEFENSE AND AEROSPACE INDUSTRY EXPORTERS' ASSOCIATION OF TURKEY (SSI) AND TURKISH DEFENSE ALLIANCE (TDA)

- **As the premier organization for defense exporters in Turkey you present the world with an image of Turkey's defense industry. What about Turkey's defense sector makes it attractive to foreign governments and companies?**

A relatively young sector, the defense industry is critical for Turkey as well as the world. No matter how young, it is one of the fastest growing sectors. In the past nearly 50 years, our sector achieved great success, especially in the last 10 years, when it became one of Turkey's strongest. We are increasing this force through our export volume, which are growing every year.

The defense and aerospace industry contains both military and civil components. Although it appears to be an intergovernmental sector, civil companies are also among its customers. Participation from all segments of such a dynamic sector is of vital importance for us. The Defense and Aerospace Industry Exporters' Association (SSI), is in-

creasing its sectoral efficiency. In this sense, the participation of companies operating in civil aviation, security and maintenance and repair in our association will surely help us meet our goals.

The defense industry has an integrated structure. A single product's supply chain is composed of many companies and thousands of sub-products. At the same time, the industry has a wide logistical network that covers the stages from design to production, from small- medium-sized enterprises (SMEs) to lobbies. And presently, this network covers the whole world. International cooperation is crucial and indispensable for our sector.

What activities does SSI undertake to support Turkey's relationship with the international aerospace and defense market?

It is not easy to survive in an environment with such tough competition and exist in the vendor/supplier list. At this point, international relations and promotion are as important as production. SSI is conducting efficient activities for the promotion of the sector, and will continue these. The term 'export' lies undergirds the sustainability and strengthen of the sector, so we are striving in all available environments to increase recognition and awareness of Turkey's exports capacities.

One may put forth great products without faults or production delays, yet if one is not recognized, this will not be noticed at all. The Defense and Aerospace Support and Promotion Group of the Turkish Defense Alliance (TDA) was established in 2013 and has been working to establish a global Turkish brand in defense industry. It has also been serving as an intermediate agency that promotes Turkish companies.

In cooperation with Undersecretariat for Defense Industries (SSM), we are organizing national participations to international defense industry exhibitions. These events gather the whole sector and bilateral negotiations between delegations are conducted between government officials and military representatives. The exhibitor companies are quite sensitive about these negotiations, as strategic partnerships and cooperation amongst countries play a significant role in procurements. Thus, the number of our participant companies and therefore Turkish defense and aerospace industry's efficiency has been increasing. For this reason, we are continuing to participate to the internation-

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Our goal is to exist amongst the major global suppliers of defense industry. Today, as a country that manufactures its own satellites, unmanned air vehicles, training aircrafts, helicopters, infantry rifles, battleships, armored vehicles, missiles and rocket systems. We develop simulations and software, build partnerships in worldwide projects such as F35, A400M, construct satellite manufacturing and test centers, initiate satellite-launcher base construction, and launches indigenous helicopter projects.

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al, prestigious events organized towards target markets.

Given the high value-added nature of its products, increased research and development (R&D) investments, and sizable employment, how will the defense industry take its success to the world market? Will the industry be able to transfer this success into reaching the 2023 goals of exporting \$25 billion dollars?

The Turkish defense and aerospace industry gained a considerable impetus in exports, especially in the last few years. In a sense, we are 'producing in Turkey, becoming a brand in the world'. Our defense sector, growing as a result of the intensive R&D activities and great technological investments, is now capable of exporting a considerable proportion of its production. In such a competitive area, we are together taking the steps towards becoming a brand in defense and aerospace industry and increasing our market share.

Our goal is to exist amongst the major global suppliers of defense industry. Today, as a country that manufactures its own satellites, unmanned air vehicles, training aircrafts, helicopters, infantry rifles, battleships, armored vehicles, missiles and rocket systems. We develop simulations and software, build partnerships in worldwide projects such as F35, A400M, construct satellite manufacturing and test centers, initiate satellite-launcher base construction, and launches indigenous helicopter projects. We are able to reach these goals because of our qualified human resources, research institutes, R&D laboratories, SMEs, and major companies. ●

TURKEY'S DEFENSE INDUSTRY: A BURGEONING POWERHOUSE

By Iain MacGillivray, Analyst,
Global Risk Insights



The Turkish defense industry stands as a burgeoning powerhouse in the regional and international defense market as the Turkish Armed Forces (TAF) has played an influential role in the economic and political development of Turkey. The country is a central member of NATO, a dialogue partner in the Shanghai Cooperation Organization (SCO), and a potential candidate for EU membership. Turkey is situated in a unique geostrategic and economic position that is unrivalled in the region with access to European and Middle Eastern markets. According to Global Firepower, its military population totals approximately 411,000 active troops with an aircraft fleet of 1,020 items and tank core of 3,778 vehicles. Due to its role as an independent arbitrator throughout Turkish history, the Turkish military has maintained a unique and autonomous position regarding access to political and economic opportunities.

The Turkish military and defense sector are intrinsically tied to arms imports from the United States and Europe, providing the Turkish military with unrivalled access to cutting-edge technologies in land warfare and aerospace. Turkey consistently spends the highest percentage of its military budget on equipment and weapons. In fact, since the end of the Cold War, Turkey has spent nearly twice the NATO average on military equipment—averaging around 30% of its defense budget—unlike its European allies that have cut defense spending to levels sufficient to maintain forces with no major increases.

Turkey's procurement policy is a source of national pride and military budgets have consumed a substantial slice of the country's GDP. According to Strategic Defense Intelligence (SDI), the Turkish government will boost the country's military expenditure over the next four years with an increase from \$14.9 billion in 2015 to \$21.1 billion in 2019. This equates to around 1.7% of GDP with a set increase to 2.3% in the coming years. Turkish military equipment and procurement processes are channeled through the Undersecretariat for Defense Industries (SSM), which was established in 1985 as a means to reorganize and integrate the existing defense industry to encourage new enterprise, satisfy defense requirements

and find new sources of foreign capital and technological improvements. It was also in 1985 that a policy of offsets for military procurements was initiated in the domestic arms trade. The first offset contract was with General Dynamics for the production of F-16 parts but has since led to many more lucrative contracts with regional and international players such as the EU and Israel. The current policy prefers local development of military equipment, but if a task is too large for local defense firms, co-development or coproduction/co-licensing agreements with international consortia are pursued.

Turkey's defense industry today is booming, characterized by a steady growth over the last five years. In 2014 alone it achieved \$11 billion in orders for military equipment and a growth rate of 21%. With Ankara spending over \$1 billion on defense research and development (R&D) in 2014, Turkey is aiming for its defense companies to be among the top 100 major firms in the world, according to an industry report from the Defense and Aerospace Industry Manufacturers Association (SaSaD). Turkey has been a major supplier of military equipment and arms to countries in Central and South Asia such as Turkmenistan, Pakistan, and Azerbaijan, markets that are set to grow exponentially. While domestic projects currently consume a high percentage of growth, export and international cooperation projects will determine the sector's evolution in the future.

Turkey's defense aviation industry has seen a steady increase in exports, totaling \$1.7 billion in 2014, an 18% increase from 2013. Turkey is involved in many significant international-production and joint-design programs including the A400M Transport Aircraft and F-35 Joint Strike Fighter. In 2014, a major order worth \$6.9 billion was placed for aircraft parts. According to SSM, 90% of equipment development comes from coproduction technology with international consortia or domestically based Turkish defense firms. These co-development projects have left room for greater spending in R&D and potential defense contract opportunities in the future.

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The AKP has placed a strong emphasis on updating its military hardware and promoting domestic production and self-reliance. While the Turkish domestic market may start to compete with European and U.S. companies in individual weapon and equipment sectors, it will still have to rely on foreign armaments and equipment to reinforce its national defense systems.

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Over the last ten years, Turkey has embarked on a defense procurement policy aimed at manufacturing and development. These policies have been designed to help the Turkish military become self-sufficient, with a strong domestic supply base, and strengthen its position as a regional and international defense powerhouse. As a result, there has been a pursuit of technological transfers and co-production contracts, as well as a rise in foreign defense equipment being built locally in Turkey. This has led to a steady increase in arms exports in the last five years, development of UAV technology, and a military modernization process within Turkey's navy and air force. Turkey is currently managing over 600 modernization programs and, according to SDI analyst Moutushi Saha: "Turkey is in the process of increasing its existing armory through the acquisition of up to date and advanced weaponry including attack helicopters, multi-role fighters, anti-missile ships, guided bombs, and self-propelled guns."

There have, however, been instances of controversy, as Turkey has pursued equipment and technological transfers with non-NATO members including China and Russia.

The Turkish Armed Forces is also in the process of updating Turkey's aerial dominance in the region with a proposed program to modernize Turkey's F-16 fleet, the planned building of the 200TF-X aircraft manufactured by the Turkish Aerospace Industries (TAI), and increased purchasing of Black Hawk multi-mission helicopters. Turkey has also sought cooperation with European consortia to develop its aerospace industry. Analysts at Global Security have stated: "In December 2010, officials of Italy's defense industry giant Finmeccanica, a partner in MBDA, offered Turkey to build Eurofighter jets jointly, as Turkey's F-4 fleet is too old and it would take at least ten years for the first F-35 fighter jet delivery. They said new generation Eurofighters could be manufactured jointly by the EU and Turkey."

These new aircraft would work alongside the F-35 fleet and reinforce Turkish Air supremacy. So far this project has continued with a new memorandum of understanding (MOU) signed in 2014 for

Turkish defense company ASELSAN to manufacturer EJ200 engine systems in cooperation with Eurojet for Eurofighter Typhoon combat planes. As of now, however, the F-16 fleet remains the backbone of the Turkish air force and Turkey continues to upgrade these fighters in tandem with Lockheed Martin while it pursues its own domestic fighter fleet.

Turkey's military modernization also comes as the country finds itself in an increasingly isolated position in the Middle East. On the country's southern border, the Syrian civil war has started to impact Ankara's ability to maneuver. Russian involvement in the war has also exacerbated problems with Turkey, especially after the shooting down of a Russian military jet by one of the Turkish military's F-16 fighter jets. On top of this, Turkey has re-engaged in conflict with the Kurdish separatist movement (PKK) in the country's southeastern region. As peace negotiations have deteriorated and there is no end in sight to either of the conflicts, military equipment and expenditure will increase as Turkey tries to secure both its domestic and regional security. Overall, the Turkish defense industry finds itself in a favorable time given that there will be continued and steady growth, as Turkey seeks to develop its domestic market and promote itself as a burgeoning defense and arms powerhouse. The current ruling Justice and Development Party (AKP) has placed a strong emphasis on updating its military hardware and promoting domestic production and self-reliance. While the Turkish domestic market may start to compete with European and U.S. companies in individual weapon and equipment sectors, it will still have to rely on foreign armaments and equipment to reinforce its national defense systems. As Turkey tries to secure and legitimize its regional stance, there will be more cooperation with NATO partners and companies to provide the necessary equipment and military modernization of the Turkish Armed forces. The defense sector will experience steady growth, particularly as the United States, NATO, and Turkey become further involved in the Syrian Crisis and as Ankara continues its domestic conflict with the PKK in the country's southeast. •





COMMANDING FROM THE FRONT: GOVERNMENT, CLUSTERS, AND ASSOCIATIONS

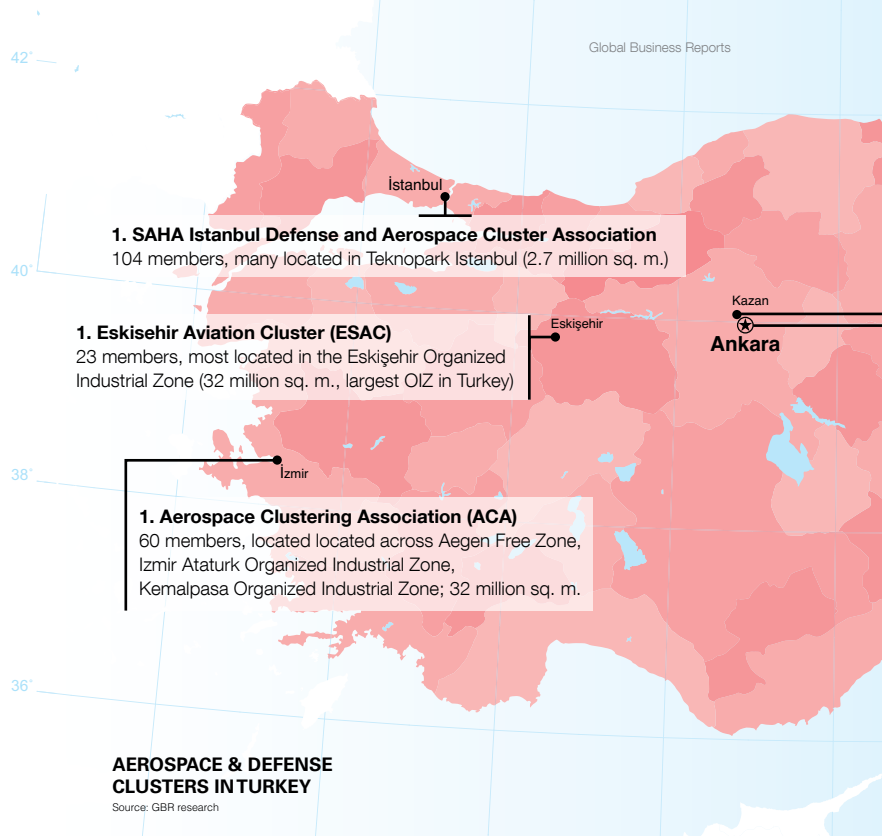


“OSSA Defense & Aviation Cluster serves as a point of contact between its members, the government, and major industrial companies in Turkey such as ASELSAN, Turkish Aerospace Industries, Inc. (TAI), and Roketsan. We also play an important role as an interface between large international companies and our members. As an association we are working to develop our members’ businesses abroad as well as their level of competitiveness by providing them with education and consultancy services.”

- Hilal Ünal Türkan,
Cluster Coordinator and Project Manager,
OSSA Defense and Aviation Cluster

CENTER OF GRAVITY

Clusters and Associations in Turkey's Aerospace and Defense Industry



Turkey's efforts to strengthen its indigenous military capabilities are supported by defense-focused clusters and special investment zones in Ankara, Eskisehir, Izmir, and Istanbul. Like many other successful economies, the Mediterranean nation has turned to the cluster model to promote growth and competitiveness of select industries, including aerospace and defense (A&D). In line with this policy, five major A&D-focused clusters have established themselves as centers of excellence across the country over the last eight years. These include: OSSA Defense & Aviation Cluster, Teknokent Defense Industry Cluster (TSSK), Eskisehir Aviation Cluster (ESAC), Aerospace Clustering Association (ACA), and SAHA Istanbul Defense and Aerospace Cluster. Member companies are situated within various technology development zones (TDZs) or technoparks, organized industrial zones (OIZs), and free zones across the country.

The bulk of Turkey's A&D industry is concentrated in the capital city of Ankara alongside policymakers and government institutions. OSSA was the first A&D-focused cluster founded in Turkey, and is situated in Ankara. Since establishment in 2008, the cluster has grown its member base to 158 small- and medium-sized enterprises (SMEs) that are focused on manufacturing and scattered primarily across the city's OSTIM Industrial Zone. "OSSA Defense & Aviation Cluster serves as a point of contact between its members, the government, and major industrial companies in Turkey such as ASELSAN, Turkish Aerospace Industries, Inc. (TAI) and Roketsan. We also play an important role as an interface between large international companies and our members. As an association we are working to develop our members' businesses abroad as well

as their level of competitiveness by providing them with education and consultancy services," said cluster coordinator and project manager Hilal Ünal Türkan.

While OSSA Defense & Aviation Cluster represents Turkey's A&D manufacturing arm, other newer clusters such as TSSK target Turkey's research and development (R&D) capabilities. The bulk of TSSK's 93 members are situated within the prestigious Middle East Technical University Park or ODTÜ Teknokent, a TDZ where many of Ankara's budding A&D startups are gaining traction. TDZs are designed to foster R&D through collaboration between universities, companies, public institutions and other relevant organizations. TSSK's innovative member companies are working hard alongside the university to build critical technologies and help Turkey become progressively more import independent.

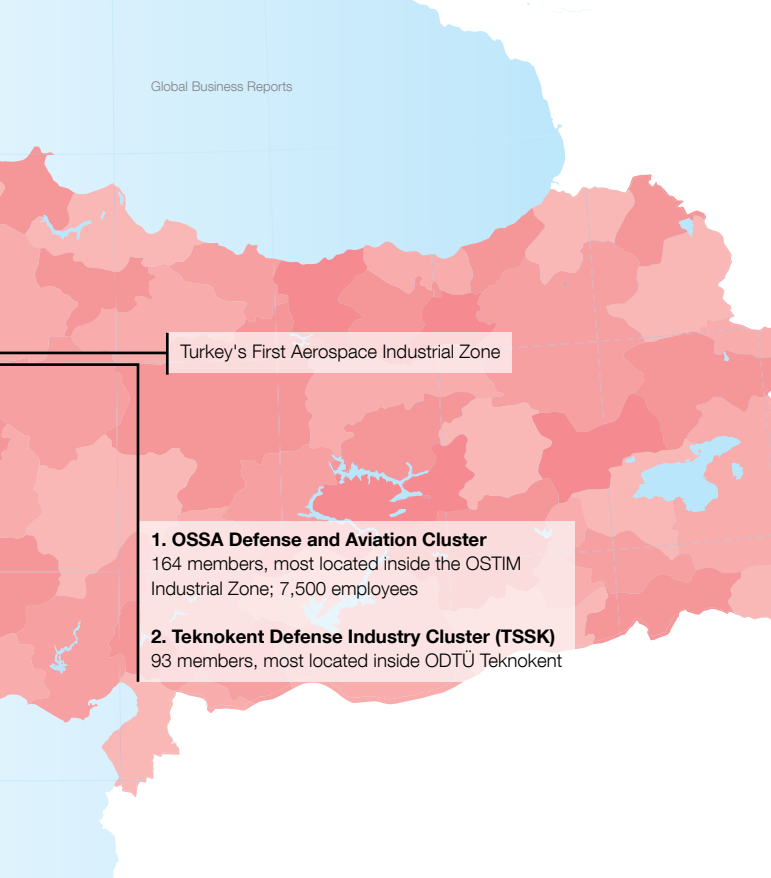
"The ultimate goals are to fulfill the requirements of the Turkish Armed Forces and to position the Turkish defense industry as a significant player in the world market through high-technology solutions, products and services presented to the international market," said chairman of the board Fatih Unal.

Additional initiatives are being taken by the government to promote technological development, including the establishment of

Turkey's first specialized aerospace industrial zone in the Kazan District outside of Ankara. To accommodate the growing defense industry, the upcoming OIZ will host 120 companies within 7,230 million square meters. A total of 50 million TL was spent to build the zone, in line with Turkey's 2023 goals to expand its defense sector.

The ultimate goals are to fulfill the requirements of the Turkish Armed Forces and to position the Turkish defense industry as a significant player in the world market through high-technology solutions, products and services presented to the international market.

*- Fatih Unal,
Chairman of the Board,
Teknokent Defense Industry Cluster (TSSK)*



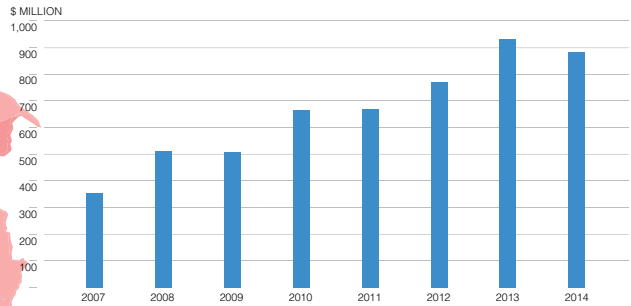
Turkey's First Aerospace Industrial Zone

- 1. OSSA Defense and Aviation Cluster**
164 members, most located inside the OSTIM Industrial Zone; 7,500 employees
- 2. Teknokent Defense Industry Cluster (TSSK)**
93 members, most located inside ODTÜ Teknokent

Further outside the capital city, A&D hubs have flourished in a number of localities around Turkey. Just 200 kilometers west of Ankara, the northwestern city of Eskisehir hosts the strategic aeronautical cluster, ESAC. Key international players such as General Electric and Sikorsky Aircraft have established their presence there through joint ventures with local companies, making way for engine giant Tusaş Engine Industries, Inc. (TEI) and key parts supplier ALP Aviation, respectively. On its own, Eskisehir is responsible for 100% of national aircraft engine production. The local cluster ESAC comprises 23 companies and represents the interests of both its international members as well as its strong local base, as it strives to promote itself on a global scale. The majority of ESAC's members are located within the Eskisehir OIZ, the largest and cheapest OIZ in Turkey, with a capacity of 32 million square meters priced at approximately 15 Euros per square meter. Yet another hub for Turkey's fragmented A&D sector is located in the coastal city of Izmir. Home to sandy beaches, ACA, and the ESBAS Aegean Free Zone, Izmir has attracted some of the industry's biggest international names to Turkey including PFW, Fokker Elmo, Pratt and Whitney, and Saab. The zone grants select fiscal advantages to companies situated within its borders, including exemption from customs duties, corporate income tax, and VAT. ACA first established its presence in Izmir, and has since expanded its member base to 49 companies throughout Turkey. Finally, as a growing international hub, prime travel destination and Turkey's financial capital, Istanbul too is playing a growing role in Turkey's A&D sector. Marked by the establishment of the industry's newest cluster in 2015, SAHA Istanbul Defense and Aerospace Cluster, Istanbul is slowly but surely realizing its A&D potential. "Companies are coming to Istanbul either by establishing branch offices or relocating from Ankara to be closer to international names, airports, and strategic destinations," explained international relations coordinator at Teknopark Istanbul, Sercan Altinbas.

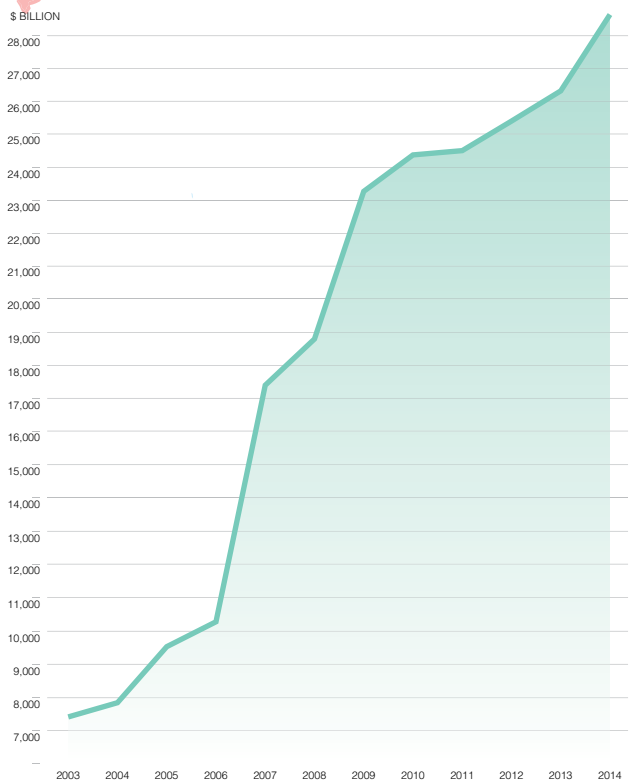
TURKISH AEROSPACE & DEFENSE ANNUAL R&D INVESTMENT

Source: SSM

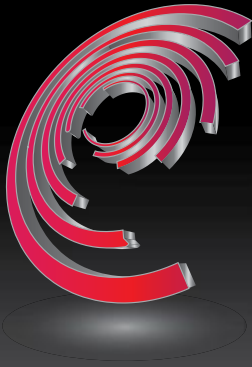


SSM-CONTRACTED PROJECTS (\$ BILLION)

Source: SSM

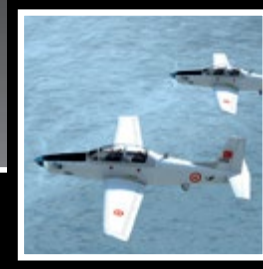


The founding of SAHA Istanbul Defense and Aerospace Cluster exemplifies this trend, as the group continues to add more A&D companies to its member base. The new cluster is working in partnership with Teknopark Istanbul, a local TDZ that will host many of the cluster's members. Of Teknopark Istanbul's members, 30% are producing defense technologies, and include names such as Yaltes, Siemens, and General Electric (GE). Overall, Turkey's A&D industry is scattered throughout the country, and comprised largely of SMEs. While the clustering initiative has helped some of these firms gain recognition, the policy tool can be further utilized to promote collaboration, strengthen the links between academic institutions and the industry, and bolster the visibility of Turkish SMEs abroad. Moving forward it will be crucial for Turkey to build its own knowledge base in order to strengthen local content and market itself on a global scale, and clusters can play a seminal role in furthering these objectives. ●



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K. Nail Kurt

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Chairman of the Board

DEFENSE AND AEROSPACE INDUSTRY MANUFACTURERS ASSOCIATION (SASAD)

- **The Defense and Aerospace Industry Manufacturers Association (SaSaD) is the premier organization for defense manufacturing companies in Turkey. Could you provide a brief introduction to the history of SaSaD and its current role in the industry?**

SaSaD was established in 1990 by a Ministry of National Defense directive with full support to represent the Turkish Defense Industry. In 2012, SaSaD integrated Turkish manufacturers in civil aviation and space industry to make SaSaD the main association to represent the defense, aerospace, space, and security sectors in Turkey with 157 member companies. The mission for SaSaD is to represent and support the industry by facilitating partnerships with the government, lobbying for beneficial regulations, identifying market opportunities, gathering performance statistics for the industry, and organizing and attending promotional events for the industry.

SaSaD provides an excellent overview of recent statistics and trends for defense manufacturing until 2010. What are the trends and statistics for industry growth over the last five years?

The current outlook for the defense sector is strong with year on year trends such as increasing exports that reached \$1.85 billion in 2014 as compared to \$835 million in 2010. There is a slight discrepancy in export numbers compared to government data because they do not count services. In regards to defense and aerospace industry turnover, the industry moved from \$4.1 billion in 2010 to \$5.1 billion while during the same period equity-backed research and development (R&D) more than doubled from \$143 million to \$350 million in 2014. Of course, the largest part of R&D spending was undertaken by the government, which has fluctuated year to year but remained a steady element within the industry. In terms of key sectoral elements behind this trend aeronautics and space and electronics have been the key growth drivers with \$1.2 billion and \$1.4 billion of total industry turnover for 2014, respectively. Looking forward, the expectation for the next 10-year compounded annual growth rate is 4% to 5%, whereas for the last five years it was 5.5%.

Defense and aerospace products often have many technical requirements that have to be met, requiring technically competent people for manufacturing. How able are aerospace companies to hire high quality personnel?

The most critical and important issue for the aerospace industry is the acquisition of skilled personnel. In the last 15 years the industry has invested heavily to develop quality personnel with particular focus on design engineering skills. Currently there are special programs supported by the Undersecretariat for Defense Industries (SSM) to encourage university education related to the defense industry and orientation for new employees in the sector. After universities observed resource shortages the government started to apply education policies to meet industry's requirements. So while important progress has been made, the problem in human resources has not been completely solved. No one was considering what to do to educate people in the defense industry 10 years ago, but now that there is a high demand and there are more resources

being applied. The current effort will need to be improved, but it is on the right track.

There are several large aerospace projects being developed, as well as ambitious goals to grow the industry by 2023. Where do you see the industry heading in the next three to five years?

My view is that there should be more government controls in the industry. The aerospace and defense sector is not a place for liberalism. There have been some discussions over the past few years as to how many players that should be around at the system level, but the more players the more trouble for Turkey. The current strategy should be followed strictly; there is a good enough environment for smaller industries. What is missing is critical technologies that have been invested in but are not quite there yet. In those critical technology areas, there must be tier-one suppliers as systems providers to original equipment manufacturers (OEMs) and this is probably the weakest part of Turkish OEMs compared to Western OEMs. We realize that it will take time and will not be easy but if the industry cleverly identifies those areas and invest in them carefully, the capabilities and strength of defense and aerospace industry will be elevated to the next level.

Turkey needs to continue improving and investing in new products, whether they are required by the armed forces or not. You need to be considering ten-fifteen years ahead of time and have your quality people work on those future requirements to come up with creative solutions. Not all of them will end up with serial production, but you have to be supporting high quality researchers with developing programs. This has been happening in the United States and Europe, where they are seeing the results. New products including naval platforms, the HÜRKUŞ Training Aircraft, the ATAK Helicopter, Main Battle Tank, Air Defense Systems, and regional aircraft should start seeing exports in the near future. ●



Fatih Ünal

●●●
Chairman of the Board

TEKNOKENT DEFENSE INDUSTRY CLUSTER (TSSK)

Although defense companies are comprised of a large number of products and systems, in many countries aerospace takes up the largest portion of their exports and costs. What is the importance of aerospace to TSSK-associated companies?

Currently, TSSK has 93 companies operating in defense, aerospace and security, spread to four technology parks in Ankara, namely ODTU TEKNOKENT, BİLKENT Cyberpark, Hacettepe Teknokent, and Gazi Teknopark. Ankara's major industrial base is focused on aerospace and defense and accordingly TSSK members are working in defense and aerospace area. Some members provide subsystems to aerospace programs in Turkey, such as airborne digital data recorders, airborne missile control systems, airborne digital moving map computer and flight control computer, etc. whereas some members develop tactical unmanned aerial vehicles (UAVs), aerostats and similar platforms or some provides engineering and training simulators for these air platforms.

Only 8 of the 93 members in TSSK are categorized as players in the aerospace sub sector of the defense and aerospace, but other TSSK members are dealing with electronics units, software development, and simulation products are also providing products and services to aerospace. Obviously, there are ongoing aerospace programs like Turkish attack helicopter, ANKA MALE UAV, Hurkus training aircraft, Karayel Tactical UAV, F-16 modernization, Turkish general purpose helicopter programs in which various members of TSSK take part including the major players like partial operation of TUSAŞ, ASELSAN and HAVELSAN within ODTU TEKNOKENT. Moreover, there are new programs like the indigenous light helicopter program and others to be launched very soon, such as the implementation phase of the national fighter aircraft program and a new program in civilian aviation, regional jet program. TSSK members are working to take roles in these programs with the products and capabilities that they have. This is crucial for our sector because the only way that we can make indigenous airborne platform programs that can compete in the export market is to localize the subsystems by utilizing small and medium-sized enterprises having vertical expertise, universities, and R&D organizations in the right combination.

Part of TSSK's mission is to promote its members internationally and facilitate col-

laboration and information sharing. What are some of your successes and challenges in these areas?

The cluster concept is growing popular both in Turkey and throughout the world. The concept highlights an industrial synergy model that emphasizes SMEs and the contribution of specialized and efficient structuring to economy. This is also in line with SSM's strategy to widen the industrial base and increase the vertical expertise.

TSSK aims to achieve the following targets by providing synergy among its members aimed to develop and produce sustainable products via industry-industry cooperation and industry-university cooperation that will provide important contribution to our country to have indigenous defense and aerospace platforms and systems and also to have them as competitive as possible in the export market. In order to achieve these targets, TSSK will do: (1) develop new products and technologies through effective and complementary interactions between players assuming different roles within the techno-park setting – such as industries, universities and research organizations; and (2) ensure the development, expansion and sustainability of new R&D and product ideas within this ecosystem that, in line with the commercialization objectives, lead to an increase in market share.

What are TSSK's plans for the next five years?

TSSK will conduct extensive activities to ensure that its members can take on an effective role in new and large-scale programs, such as regional aircraft, the Turkish fighter development (TF-X), indigenous helicopter, and cyber security. In this context, TSSK plans to hold various training sessions in the first quarter of 2016 to increase the competitiveness and technical competencies of its members in the relevant areas, while also assisting its members in gaining access to various public support programs. To diversify the areas of activity and the customer portfolio of TSSK companies, we will continue to promote their activities in civil areas through emphasis on dual-use technologies.

In January 2016, we held Project Market Day at the ODTU Cultural and Convention Center, under SSM's participation and TÜBİTAK's support as well as the participation of large-scale players in our sector such as ASELSAN, TAI, ROKETSAN, HAVELSAN, FNSS and Otokar. •

●●● **The TSSK is a newer cluster. Could you provide a brief introduction to the development of the TSSK cluster and its role?**

Teknokent Defense Industry Cluster (TSSK) was established in 2010 among the defense, aerospace, and security companies at the Middle East Technical University Technology Park (ODTU TEKNOKENT) in the beginning. It then became a common platform for all the defense, aerospace and security companies that operate in technology parks in Ankara, not just ODTU TEKNOKENT.

TSSK hosts 93 defense, aerospace, and security companies doing research and development (R&D) and product development. The cluster provides added value to generate more synergy and cooperation among its members, with universities for applied research in defense sector, and with major contractors in the market. The ultimate goals are to fulfill the requirements of Turkish Armed Forces and position the Turkish defense industry as a significant player in the world market through high technology solutions, products, and services presented to international market.



Hilal Ünal Türkan

Cluster Coordinator and Project Manager

OSSA DEFENSE AND AVIATION CLUSTER

●●● To begin please provide a brief history and introduction to the services that OSSA provides.

OSSA was established in 2007 as a result of a competitiveness analysis that was conducted in the OSTIM Industrial Zone, an organized industrial area comprised of 5,000 companies and approximately 50,000 workers across 17 sectors. The analysis identified strategic sectors, which included aerospace and defense, compelling the management to establish a cluster. Over the years we have built our member base to include over 160 member companies, most of which are manufacturing sub suppliers located in Ankara.

OSSA serves as a point of contact between its members, the government, and major industrial companies in Turkey such as ASELSAN, Turkish Aerospace Industries, Inc. (TAI), and Roketsan. We also play an important role as an interface between large international companies and our members. As an association we are working to develop our members' business abroad as well as their level of competitiveness by providing them

with education and consultancy services. For example, we conduct trainings for AS9100 certification and SEO optimization, inform our members of foreign trade protocols, and provide them with specialized country information.

Aerospace is a specialized industry requiring custom components and high quality. What specific programs within universities and schools are available to train aerospace professionals? How does OSSA facilitate collaboration in this regard?

OSSA maintains good relationships with a number of Turkish universities that offer relevant faculties. In Ankara there are many technical schools including the University of Turkish Aeronautical Association as well as Middle East Technical University, which has an aerospace engineering department. In Eskisehir, Anatolian University boasts a reputable civil aviation department from which students often come to find jobs in Ankara due to the concentration of industry here. OSSA is working to attract more students to the cluster.

Among OSSA members, what is the ratio of civil aviation projects to defense aviation projects?

While we are unable to make a definite distinction, it is clear that civil aviation is growing. Roughly half of companies' business volume stems from civil aviation while the other half comes from defense. Four years ago a majority of projects were defense-related—approximately 70%—whereas at present many defense projects have already been completed. It is easy for defense companies to shift their focus in the direction of civil aviation, and they are choosing to do so.

In terms of business models how does the mix of civil and defense affect companies with regards to their ability to grow?

Previously there were more active defense projects that spurred growth, but the number of projects has dwindled. In contrast to shorter defense contracts, civil aviation requires at least a five-year plan. These longer production cycles help small- and medium-sized enterprises grow, and hence we are trying to develop civil aviation companies.

Turkey can serve as an optimal solution for civil aircraft manufacturing systems, due to the fact that it is not in the euro zone, and has good experience as a result of its work in the defense sector. We have the capability, cul-

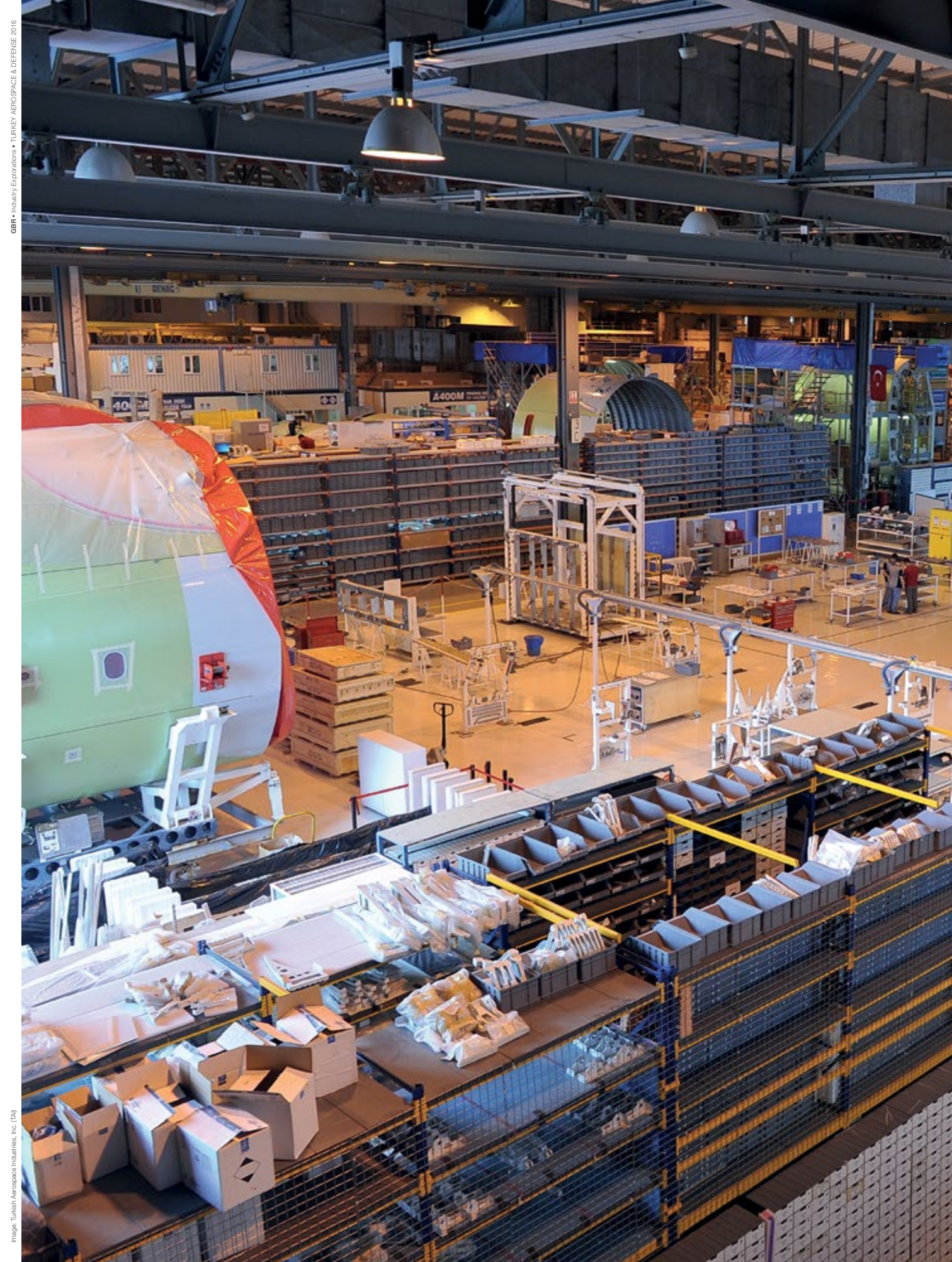
ture, and manufacturing skills, meaning that European companies can work well with us. Furthermore, TAI and TUSAŞ Engine Industries, Inc. (TEI) are very good prime contractors and Turkey is a large customer for Boeing and Airbus, as Turkish Airlines continues to purchase many aircrafts each year. Hence Turkey will be a good solution in the long term, especially for Airbus.

Increasing the share of domestic production is OSSA's major goal. What is the cluster doing to reach this goal?

We as OSSA are an association that works to assist our member companies with their development. Other companies abroad can utilize our database, knowledge, and experience at no cost. OSSA knows each company, as well as their strengths and capabilities, and we want to be the first point of contact for any international contracts.

Do you have a final message for our international readers?

Every two years OSSA organizes an event in partnership with business-to-business (B2B) event organizer BCI Aerospace in Ankara known as International Cooperation Days in Defense and Aerospace (ICDDA). Our last two events effectively helped attendees to source appropriate contacts, offered workshops and facilitated B2B meetings. In 2014, 34 countries were represented with more than 250 companies, and 4,800 B2B meetings occurred within two days. Large international companies including Boeing, Airbus, and Sikorsky have asked us to organize the event every year and most have already registered. Representatives from the Middle East, Turkish republics, Europe, United States, and other Asian countries such as Malaysia and Indonesia will attend ICDDA, making it an attractive forum for the industry at large. •





DOMESTIC DRIVE: TURKEY'S AEROSPACE & DEFENSE OEMS



“A prime example of our work in developing Turkey’s next generation of indigenous aircraft is the HÜRKUŞ program, which started in 2006 to develop a state-of-the-art trainer aircraft. The HÜRKUŞ aircraft allows different mission configurations, features a next generation glass cockpit, unique high tandem seating configuration, best-in-class pilot view, on-board oxygen generating system and a high-power engine.”

- Muharrem Dörtkaşlı,
President & CEO,
Turkish Aerospace Industries, Inc. (TAI)

LEVELING UP

Turkey's Major Platforms and Systems



Militaries need quality platforms to leverage force in the most effective manner. While the most powerful weapon in any military is people, platforms can provide a force multiplier effect for any military unit. They can also help adapt to the new dilemmas in national security, such as information warfare and intra-state conflicts. Cognizant of these new challenges, Turkey has commissioned a number of high-profile defense platform projects including aerospace platforms, unmanned aerial vehicles (UAVs), land platforms, naval vessels, and air defense missile systems, all of which will help grow its domestic defense industry and strengthen its indigenous capabilities.

Turkey has launched a large number of new indigenous aerospace platform projects, which are some of the country's most expensive, technologically intensive, and highest-grossing projects. The largest aerospace company in Turkey, Turkish Aerospace Industries, Inc. (TAI), has begun working on several new projects. "During the last decade, TAI has changed itself from a subcontractor company into an original equipment manufacturing with the development of products like the ANKA medium-altitude long-endurance (MALE) class UAV, the HÜRKUŞ primary and basic trainer aircraft, and the T129 ATAK multirole combat helicopter," said president and CEO Muharrem Dörtkaşlı.

TAI is also developing a light-utility helicopter, which will be the first indigenous rotary wing project for Turkey, as well as a new fighter jet in partnership with BAE Systems within the TF-X program. The TF-X will be a fifth-generation fighter, similar to an F-22, and will provide an air dominance role to complement the F-35. Currently the HÜRKUŞ is the furthest along in its development lifecycle and should be operational in 2018.

Turkey is also progressing in the UAV market, where there is significant room for global growth and differentiation. According to Otonom Teknoloji's general manager A. Nezir Erturk, the main factors that will differentiate Turkish UAV platforms in the market are, "the attributes they can provide, especially in surveillance, where the end users are sensitive to the payload that these platforms can provide. Other attributes include the range, response time, altitude, cost, and endurance."

All-weather aerial surveillance is particularly needed, and indigenous platforms like Otonom Teknoloji's aerostat Tepegöz UAV or Baykar's Bayraktar Mini UAS are able to provide such capability. For larger payload and altitude requirements, however, MALE UAVs such as TAI's ANKA and Baykar's Bayraktar Tactical UAS

will be able to fill the gap especially in export markets. Global demand for MALE UAVs is expected to reach \$13.5 billion in the next ten years and demand from Middle Eastern countries, where border security is a priority, is expected to be particularly robust. Land systems are another major area where Turkey is making significant investment, most notably with its Altay Tank project. The Altay is a third generation battle tank under development by Otokar with technical support from Hyundai Rotem. The new tank will incorporate several new technologies such as ASELSAN's AKKOR active protection system, ROKETSAN's designed modular armor, and a 120-millimeter turret designed by the Turkish Mechanical and Chemical Industry Corp. (MKE). Bids for the contract for the tanks' serial production will be accepted in the near future, and other land-platform companies like FNSS and BMC are likely to bid on the contract. BMC is also the producer of Turkey's first indigenous mine-resistant ambush-protected vehicle, the Kirpi. Yet, much like many other indigenous platforms, the Altay project has faced delays and problems related to engine development. It was only in March 2015, eight years after the start of the project, that Turkish engine developer TUMOSAN signed a contract to build an indigenous engine for the tank project. TUMOSAN will receive technical assistance from AVL List, an Austrian firm. The Altay project will see significant production for Turkish military use and has strong export potential like Turkey's other land systems, including FNSS' Pars armored combat vehicle, of which 267 were ordered by Malaysia.

In the realm of naval projects, Turkey is developing and producing two major indigenous systems: the MILGEM patrol and anti-submarine warfare corvette, and the air-defense frigate or TF2000 program. The corvettes are multi-purpose vessels made for surveillance, anti-submarine warfare, and other purposes. The MILGEM class corvette program is already underway, having launched two ships with two more under construction. Construction by private shipyards is ongoing and the remaining ships will be built and launched as upgraded versions of the original design. The TF2000 frigate is still in the development phase, but will be used in air defense.

Recently, there have been additional announcements about including a laser-weapon system on the frigate, which is under development by the scientific research council of Turkey TÜBITAK, military electronics and radar manufacturer ASELSAN, and Bilkent University. Development of these capabilities will bring Turkey's





Image: HÜRKUŞ Primary and Basic Trainer Aircraft. Turkish Aerospace Industries, Inc. (TAI).

navy in line with that of the United States, whose laser-weapon system was tested this year on the USS Ponce. The development of an indigenous laser system could drastically reduce ammunition costs for the navy. These new vessels and systems coming into development are benefitting private shipyards that have experienced lagging growth due to a downturn in global trade following the 2008 financial crisis.

“To rekindle the entrepreneurial vigor from before the crisis, the Turkish government strategically invested in the naval sector for the domestic production of naval vessels for the Turkish Navy,” said Atilla Çiftçigüzeli CEO of Istanbul Shipyard.

This has allowed the naval industry to propel itself forward and upgrade the industry’s technical capabilities.

Two of the most important and high-profile indigenous missile systems under development are the HISAR-A and HISAR-O low- and medium-range air defense systems. The HISAR series air defense systems are designed for short-to-medium-range use and developed by ROKETSAN, a major rocket producer, and ASELSAN. The project is successfully moving into its test phase and the system is nearing completion for use in 2017. The development of short- and medium-range air defense systems is one thing, but longer-range systems are much more complex and require another level of research and technology.

Turkey has been considering the acquisition of a long-range air defense system for more than twenty years and, having compared Russian, Chinese, and Western contractors, has undergone a number of vacillations. In the latest twist of the procurement saga, the Chinese bid was rejected and it was announced that Turkish companies, likely ASELSAN and ROKETSAN, would develop the system. This complex system requires radar, command and control, fire control, and advanced missiles, and developing such technology will be a challenge. Furthermore, given Turkey’s large geography the system will have to be deployed over great distances, increasing both the cost and time needed for the project. The Turkish government is a committed supporter of the defense industry, and Turkey’s status as a NATO member will make it

easier for technology sharing to speed up the process. Regardless, the long-range air defense system will require a large budget, foreign technical assistance, and patience to realize.

Challenges Ahead

The question surrounding all defense programs is the ability to ensure on-time delivery. Although many industry leaders agree that Turkey will be able to manufacture its indigenous platforms, there are disagreements over timelines and the levels of foreign technology that will be required. Fully indigenous platforms are not impossible to design and produce, but it is also unrealistic to confect such platforms—engines in particular—without incorporating some level of foreign technology. Lastly, none of these programs, moreover, will realize significant levels of export without operational use by the Turkish Armed Forces, and delays will only serve to increase the likelihood that the military will procure foreign platforms to meet pressing operational needs. The large number of prototypes for these projects means that critical tests of their viability will materialize during production and marketing phases. Despite these problems, large and technologically intensive projects will further refine the capabilities of Turkey’s A&D players.

In addition to indigenous projects, Turkey’s A&D sector is engaged in modernization, weapons development, and platform building in a number of exciting areas. Yet even this abbreviated list represents a large commitment by the Turkish government to create a world-class defense industry. The complexity of technology and delays in some projects demonstrate that it will take ten years or longer for Turkey to fully realize their benefits. The defense industry is characterized by long project horizons with long development phases and often even longer production, servicing, and modernization cycles. Only once these platforms and systems reach their full maturity can Turkey become one of the world’s top ten defense manufacturing countries. •



Muharrem Dörtkaşlı



President and CEO

TURKISH AEROSPACE INDUSTRIES, INC. (TAI)

- **Turkish Aerospace Industries Inc. (TAI) is one of the largest original equipment manufacturers (OEMs) in Turkey, boasting a portfolio of cutting edge products. Please provide a brief introduction to TAI and its current services and products.**

Turkish Aerospace Industries Inc. (TAI) was established in 1984 as a Turkish-American joint venture company to co-produce the F-16 fighter aircraft for the Turkish Air Force. Until 2005, TAI collaborated with several European and American companies as a manufacturing partner for fixed and rotary wing platforms like the CN-235 light transport aircraft and AS-532 Cougar utility helicopters. In recent years TAI has developed extensive capabilities for the design, development, modernization, manufacturing, integration and life cycle support for integrated aerospace programs that span from fixed and rotary wing platforms to unmanned aerial vehicle and space systems. TAI has evolved from a subcontractor into an OEM with the development of products like the ANKA medium-altitude long-endurance class, unmanned aerial vehicle; the HÜRKUŞ primary and basic trainer aircraft; and the T129 ATAK multirole

combat helicopter. TAI also participates in international programs as a design, industrial, and/or risk-sharing partner. Our portfolio includes: the Airbus A350 wide-body aircraft, Airbus A400M next generation transport aircraft, and F-35 Joint Strike Fighter Aircraft, to name a few. TAI has evolved to become a strategic partner and single source supplier to leading OEMs such as Airbus, Boeing, Bombardier, AgustaWestland, Sikorsky, Northrop Grumman and Lockheed Martin.

Turkey has set major goals for 2023 with the development of an indigenous aircraft at the top of the list. What are some of the major aircraft platforms that TAI is currently working on?

A prime example of our work in developing Turkey's next generation of indigenous aircraft is the HÜRKUŞ program, which started in 2006 to develop a state-of-the-art trainer aircraft. The HÜRKUŞ aircraft allows different mission configurations, features a next generation glass cockpit, unique high tandem seating configuration, best-in-class pilot view, on-board oxygen generating system and a high-power engine.

Another milestone in Turkish aviation is the development of a twin-engine, five- to six-ton, light utility helicopter. The program started in 2013 and was Turkey's first rotary wing design program. At the moment, the design process for the program is ongoing with the first flight planned for 2018.

A third prominent TAI program is the T129 ATAK helicopter developed under a special collaboration scheme with AgustaWestland. The T129 ATAK inherits features from the combat-proven AgustaWestland A129CBT and incorporates a completely new system with new engines, the LHTEC CTS 800-4A, new avionics and weapon systems, as well as a modified airframe and tail rotor. Ten helicopters have been delivered to the Turkish Land Forces, who are using these helicopters in active operations.

Boeing and Airbus dominate the global aerospace market, making collaboration with international companies on major projects and technologies a must. What is TAI's experience in working with international platform producers?

TAI maintains strong partnerships with worldwide aerospace and defense companies and is a sole source supplier for both Airbus and Boeing commercial aircraft programs. On the commercial side TAI is involved with

various narrow- and large-body passenger aircraft including A320, A330, A350XWB and B737, B787. For Airbus, TAI is in charge of the A320 section 18 and section 19, the A330 rudder components and is a risk-sharing partner for A350XWB aileron. For Boeing, TAI is responsible for the B787 Dreamliner elevator, cargo barrier, and body seal, and is a sole source manufacturer of B737, B747, B767, and B777 components. We have also established relations on the military side (A400M, F-35, S-70, and similar) for fixed- and rotary-wing platforms.

One of the most visible international projects that TAI is involved with includes the F-35 program. TAI is responsible for the manufacturing of the center fuselage, air-to-ground alternate mission pylon, and composite inlet ducts on the F-35. We have invested in advanced composite technologies due to program requirements, enhancing our capabilities for future projects.

The other international project that TAI is engaged with is the A400M Program, initiated in 2003 with Spain, Germany, France, the UK, Belgium and Luxembourg in order to develop a transport aircraft to replace the aging C-130 and C-160 transport aircraft. The Turkish government bought ten A400M aircraft, allowing TAI to work as an industrial partner responsible for the design and production of various parts of the aircraft. Serial manufacturing and deliveries are ongoing, and the Turkish Air Force already has three A400M aircraft in its inventory.

The Turkish defense industry has grown significantly over the last ten years through the help of targeted government policies. What will be the most significant developments for the industry in the next five years?

The Turkish government's Vision 2023 targets include major aviation milestone programs: a future jet trainer and fighter aircraft. The conceptual design phase of the Turkish Fighter Aircraft has been completed, and TAI's engineering team is working together with SSM and the Turkish Air Force for the follow-up phases of the program.

In the last 10 years, the yearly revenue of Turkey's defense and aerospace industry has increased fourfold, while exports have increased by five times. Research and development expenditure has also been steadily increasing, totaling \$887 million by the end of 2014. Exports in 2014 were valued at \$1.35 billion and total revenue at \$5.1 billion. These

figures indicate that Turkey is successfully continuing to become a global supplier for aerospace and defense products.

TAI is positioned as one of Turkey's top aerospace and defense companies. What are the company's plans to improve its position in the global market?

TAI will grow in two main areas: products and portfolio. This includes development projects such as FX Fighter Aircraft, Light Utility Helicopter, HÜRKUŞ Primary & Basic Trainer Aircraft and ANKA Unmanned Aerial Vehicle variants, as well as new communication and observation satellites. Through this two-pronged strategy and by enhancing our relations with leading OEMs, TAI will become even more competitive. "Defense News" currently ranks TAI 78 of the top 100 players in the aerospace and defense sector in the world in 2014, and we expect to move further up on the first 100 players list. The growth trend will endure and TAI will continue to make groundbreaking achievements for years to come. •

and their derivatives. To realize these goals TEI provides services, products and support to customers around the world as a globally recognized, competitive, and high quality manufacturing, sales and engineering center. TEI's main areas of activity include parts and module production, engine assembly and test, maintenance, repair and overhaul, engine design and product development. Recognized as a center of excellence for manufacturing parts, TEI is also the sole source for most of the parts it manufactures. TEI has expanded its product range throughout the years, and today manufactures parts for 39 different engine programs in both military and commercial aviation. TEI participates in both national and international projects including the A400M TP400 engine project—as a risk and revenue partner, the Turkish medium-altitude long-endurance (MALE) class unmanned aerial vehicle (UAV) (ANKA), T129 ATAK multirole combat helicopter and utility helicopter engine projects. TEI also services the Turkish Air Forces military aircraft and helicopter engines with experienced on-site professional technical representatives.

Engine development is a highly technical field and critical technology will allow Turkey to become more independent from foreign companies. What is the role of research and development (R&D) in reducing dependency on foreign technologies?

Defense and aerospace is one of the critical sectors for which minimum foreign dependency is desired. For this reason, significant nationalization projects are being conducted under the leadership of the Undersecretariat for Defense Industries (SSM). In order to ensure the sustainability of these projects, many R&D centers have been established in Turkey. TEI established its own R&D center in 2008, and has been performing R&D in its Eskişehir, Gebze, İstanbul, and Ankara Engineering Offices. Our R&D center was awarded as the best in aviation industry by the Ministry of Science, Industry and Technology in 2014 and 2015 because of its successful research studies. To contribute towards Turkey's 2023 vision, TEI has to prioritize R&D.

Aerospace and defense products are technically challenging to manufacture and often come with many requirements from end users. What technical challenges related to engine design is the industry currently facing?

Airline agencies and governments are con-

tinuously putting forth more aggressive requirements for future gas turbine engines. These requirements mainly include reduced fuel consumption, weight, emissions, and increased performance. Achieving such targets requires increased engine operating temperatures and higher overall pressure ratios. Engine design requires a combination of high-end knowledge and expertise on many engineering disciplines such as materials, aerodynamics, thermal systems, combustion, cooling, structural and product engineering, testing, as well as controls and electrical systems. In order to be successful in designing these complex systems, you need to have top-level engineering knowledge in every technical discipline, and prove your technical capabilities with real applications.

Given that engine design requires engineers with a combination of expertise in a number of systems, how would you characterize TEI's labor environment?

While TEI utilizes modern equipment and technologies, it is our human workforce that truly makes a difference in terms of quality and reliability. TEI tries to attract and employ the most competent people in the labor market. In order to do this, there are extensive hiring programs for both blue- and white-collar personnel. Candidates are put through personality tests, as well as technical written and applied exams to be evaluated thoroughly. In the end due to our high demands, only the best are hired. To illustrate this, today over 300 GE and TEI engineers are working for GE Aviation Engine Development Programs at the Türkiye Technology Center (TTC), which was jointly established in Gebze by GE and TEI in 2007.

What are the most promising growth areas for TEI's products and services?

Military and civil uses of UAVs are quickly expanding. One of the most important subsystems in UAVs is their engines, and TEI is looking to provide piston engines and jet engines for the UAV market. As part of the operative UAV engine development project signed with SSM, TEI is developing a diesel piston engine for Turkish Aerospace Industries Inc. (TAI)'s advanced MALE class UAV, 'ANKA'. In addition, TEI is developing a mini turbojet engine for TAI's high-speed target drone system, 'Şimşek'. After TEI completes these programs for the domestic market, they will be presented to international markets. •

Chairman, Board of Directors
TUSAŞ ENGINE INDUSTRIES, INC. (TEI)

In partnership with GE, TUSAŞ Engine Industries Inc. (TEI) is Turkey's premier engine manufacturer. Please introduce us to TEI and its main products.

TUSAŞ Engine Industries Inc. (TEI) is a joint-venture company established in 1985, through a partnership agreement between Turkish shareholders, TUSAŞ Aerospace Industries, Inc. (TAI), the Turkish Armed Forces Foundation, Turkish Aeronautical Association, and General Electric (GE). The first four parties own 53.78% of the firm while GE maintains a 46.22% minority stake in the company.

TEI's mission is to be the leading engine manufacturer through the design, production and service of globally competitive, sustainable and indigenous aviation power systems



Faik Eken

●●●
Ph.D., President and CEO
ASELSAN A.Ş.

- **ASELSAN started in 1976 with its core business of communications but has since branched out into a number of fields like electro-optics, unmanned systems, and C4ISR systems. Could you provide an introduction as to how these new businesses evolved and developed as ASELSAN grew?**

ASELSAN was established in 1975 in order to fulfill the communication requirements of the Turkish Armed Forces (TAF). The company was also founded to contribute to the formation of a local defense industry by enhancing technological capability and creating a workforce endowed with the latest technological knowhow. Since establishment, ASELSAN's in-house research and development (R&D) activities have advanced these goals. Accumulated technological knowhow through in-house R&D, complemented with international collaborations and manufacturing experience gained through licensed and co-production activities in early years, have helped ASELSAN design and produce devices and systems for all types of land, air, sea and space vehicles.

Consequently, over the past 40 years ASELSAN has become Turkey's leading defense company. Today ASELSAN carries out its activities in five different sectors: communications and information technology, microelectronics, guidance and electro-optics, radar and electronic warfare, C4ISR and defense system technologies and transportation, security, energy, automation and medical systems. We export our products to approximately 50 countries around the world and rank 62nd among Defense News World's top 100 defense companies.

ASELSAN has a number of affiliate companies and subsidiaries. How do these companies complement ASELSAN? What is their role in the future development of ASELSAN?

It is no coincidence that ASELSAN has been progressing steadily among the top 100 defense companies worldwide. We owe this success partially to our affiliates and subsidiaries, which act as our region-specific local entities in the global domain. Our subsidiaries and affiliates are essentially vessels of ASELSAN technology, and generate local value. These entities are involved in a broad range of activities including design and production to qualification and integration.

In line with a vision to become one of the best players in the global defense industry, ASELSAN has pursued opportunities for development and growth both at home and abroad. ASELSAN not only engages in direct sales to many countries but also seeks joint production with local institutions and organizations overseas through technology transfer.

As part of its growth strategy based on indigenous products, ASELSAN has evolved from being a company growing within itself to a global company buying, establishing and partnering with other companies at home and abroad. In line with this strategy we have established factories in the United Arab Emirates, Jordan, and Kazakhstan, holding 49% of the shares, to manufacture and sell ASELSAN products in these and nearby countries. In accordance with our target to benefit from foreign expertise, we founded an electro-optics design company in South Africa. Furthermore, we own a company named ASELSAN BAKÜ that administers our marketing activities in Azerbaijan.

ASELSAN has also realized technology transfer programs for our radios to be produced under license in Pakistan and Indo-

nesia. Another technology transfer has been executed between ASELSAN and King Abdullah City for Science and Technology (KACST) Institute in Saudi Arabia for local development of national radio waveforms to be used in ASELSAN Software Defined Radios (SDR). Moreover ASELSAN is already executing a contract with Military Industries Corporation, for the local manufacturing of ASELSAN SDRs, in a jointly established production facility in Saudi Arabia.

The long-range anti-air missile system tender, T-Loramids, has recently been cancelled and the government may soon commission ASELSAN and ROKETSAN to build this new and very complex system. In what areas would the T-Loramids project need international cooperation and technology? What critical technologies and strengths would ASELSAN be able to provide?

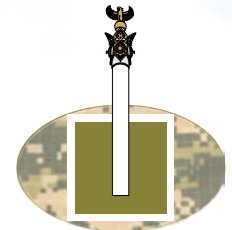
The Turkish defense industry has been commissioned to design a very important system for the air defense of our country, and we are ready to take on this major role for our national defense. These are very complex systems, or 'system of systems' since they are formed of different high-technology subsystems such as radar, missiles, command-and-control and fire control systems.

In recent years, national development has become a priority especially in the air defense field. ASELSAN has been selected as a major prime contractor for projects such as HİSAR, KORKUT and ÇAFRAD and have already started to get promising results within these projects. We are also expecting to secure the long-range surveillance radar development contract soon, one of the major components of a long-range air and missile defense system. Along with these programs, our 30 years of air defense experience and accumulated technological know-how have elevated us to a center of excellence in the air defense field. The background we have reached with these national developments may lead us to be able to directly feed an indigenous long-range air and missile defense system development program.

Not only would we be able to take a major role in system-level design, engineering, testing and qualification but we will also be supplying major components such as the radars, command-control system, fire-control systems and the seeker of the missile, all within the existing major competencies of ASELSAN. •

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Ahmet Hamdi Atalay

CEO
HAVELSAN INC.

●●● **HAVELSAN Inc. began its operations three years after its founding in 1982, and has since developed many successful international and domestic product lines. Please provide a brief history.**

HAVELSAN Inc. was founded in 1982 and commenced its operations in Ankara as a 100% Turkish company opening domestic and overseas offices in line with its new requirements. In 2004, the HAVELSAN-USA Inc. was founded in Seattle, Washington. Also in the first half of 2015, HAVELSAN purchased an U.S.-based company named Quantum 3D, which is located in the Silicon Valley and specializes in developing and manufacturing real-time visual simulation systems. With this purchase, HAVELSAN has started to be regarded as a U.S. company, which may help it tap into new markets. HAVELSAN develops technologically advanced mission critical systems and critical security systems for its domestic and overseas public and private sector customers. Parallel to developing its product and capability

portfolio, the company also aims to extend its customer base. HAVELSAN has four main business lines: C4ISR, training and simulation technologies, management information systems, and cyber and security solutions.

C4ISR projects consist of roughly half of Havelsan's total work volume. Given the recent announcement of construction of a cyber security center and a contract with Turkish Airlines for the production of simulators, does Havelsan plan to increase work volume of its additional business lines?

Software-intensive systems, such as training and simulation systems, as well as new emerging technology areas such as cybersecurity, will have great importance to our customers, and we would like to increase our market share in these areas. Globally, cyber security can be considered a very promising sector. We are making significant investments and conducting several research and development (R&D) projects in this area and have developed and launched several products. In the near future, cyber security will be a very important business line for HAVELSAN. In regard to training and simulation market, HAVELSAN is considered a regional leader and competent supplier. We have developed many critical competencies and capabilities that we can also use within civilian markets. The contract with Star Alliance Member Turkish Airlines is a big opportunity to expand our business lines to civil aviation market. By this initiative, we do not only reach global customers, but we also enrich our customer portfolio by adding non-military clients for our high-tech simulation products.

Havelsan and Aselsan recently won a contract to work on the Landing Platform Dock project. Could you tell us more about this project and Havelsan's role in it?

HAVELSAN has started to work on combat management systems with the GENESIS Project that was developed with Turkish Naval Research Center Command (TNRCC). Our company became TNRCC's industry partner and integrated the Combat Management System to 8 Oliver Hazard class frigates. GENESIS Project and the following projects such as MILGEM, OPV Combat Systems, LST were milestones in HAVELSAN's business line variety. Landing Platform Dock -with its new name Landing Helicopter Dock- Project has been the zenith of this process.

HAVELSAN will be responsible for providing: overall combat and electronic systems integration; evolved combat management system with network centric warfare capability; integration and building a joint combat management system by integration of air, land and amphibious C2IS of national and NATO systems; building Link 11, Link 16, Link 22; JREAP and VMF data link networks with various participants; support for maritime operations other than war; real-time distribution of platform data to sensors; weapons and C2 systems; building information management systems for NATO and national headquarters, integrated CCTV system.

Havelsan's domestic sales have increased in the last several years while foreign sales have slumped. What is Havelsan's export and domestic sales strategy?

Our company, which I have already mentioned in the beginning, is a Turkish Armed Forces Foundation institution. Our first aim is to develop and meet the needs of Turkish Armed Forces. Foreign sales issue is a matter of international relations. No matter how much technologically advanced products you develop, how cheap and fast you produce, defense companies are depended on diplomatic relations. In this context, all around the world defense and aviation sectors are supported by the government policies. Turkey, as a comparatively new and powerful player is on a pathway leading to more business deals in the international arena. My vision for HAVELSAN is that there will be three main sources of revenue: the foreign market sales, the civilian market sales, and the defense and security sales, including information and cybersecurity systems.

Havelsan has ambitious goals to become a global brand and regional leader in the industry. Where would you like to see Havelsan in five years?

The year 2023 is a very special year for our country, because Turkey has been established in 1923. And our aim is to become one of the top 100 defense companies of the world by 2023. We would like to increase our global presence and indeed to increase the percentage of exports within our total sales as well as boost our civilian sales both at home and overseas. Moreover we expect significant technological changes, and we would like to be a technological leader. Accordingly we are making important R&D investments. ●



Mustafa Kemal Erçelik

Member, Board of Directors
ALP AVIATION

- **Alp Aviation plays a key role in the development of the helicopter industry, including production of critical gear, spindle, and swash plate assemblies for the Turkish Utility Helicopter Program and Black Hawk platforms. Please provide a brief introduction to Alp Aviation and its role in aerospace and defense projects.**

Alp Aviation's roots originate from the Turkish Alpata Group, which already had a considerable footprint in various sectors in Eskisehir, an important center of military aerospace in Turkey. Hence the aerospace sector had been on our radar even before Alp Aviation (Alp) was established in 1998. The turning point in Alp's history came after the group's partnership with the Sikorsky Aircraft Corp. in a joint venture, which took effect in 2000. Soon after this, Alp became an approved flight-safety part source for Sikorsky, joined the F-35 program, and invested in the engine-rotating parts business. ALP also became a partner

in the Boeing 787 program in 2008, received government approval as a research and development (R&D) center, and expanded into aftermarket operations in 2013. Alp currently invests 3.8% of its revenue into R&D. Finally, Alp partook in the Achieving Competitive Excellence (ACE) Operating System in which we will reach enterprise site gold level in 2016, the highest level showing operational perfection. Since its founding, Alp had a clear plan to build a world-class company that could enter niche areas such as the manufacturing and assembly of flight-safety components and engine-rotating parts for the significant military and civilian program such as Black Hawk, the F-35 Joint Strike Fighter, and the Boeing 787. The company made strategic investments in engineering, tooling, special process applications, testing, laboratory infrastructure and cutting tool development, making Alp a vertically integrated organization.

Today, Alp is a key supplier of flight-safety components, complex rotating parts and assemblies, and a world-class center of excellence for titanium and nickel machining and processing, in addition to aluminum and steel, with magnesium lines to be operational in the near future.

- **Alp cooperates with major industry players such as Pratt & Whitney (P&W) and Boeing for certain projects. What is the importance of international markets to Alp Aviation?**

International markets are key for Alp given that over 90% of our sales come from exports, not only to Sikorsky, as our sales to Sikorsky account now for less than 35% of our turnover. Alp's aim is to partner with key original equipment manufacturers (OEMs) in high-volume and promising programs with our strategic goods and services, a target we have achieved so far. Alp's international activity includes, but is not limited to, the significant work share in U.S. Blackhawk programs, involvement as the only non-U.S. partner of Goodrich LG (now UTAS Landing Gear) on the F-22 program, partnering on R&D with P&W on the F-135 Nickel integrally bladed rotors, supply to Pratt & Whitney, of key rotating components for the new generation gear turbofan engine. Alp has also evolved to become one of the top two subcontractors for UTAS Landing Gear in the JSF program in dollar terms over the last decade,

and is a major global source for Sikorsky Machine & Transmission Centers. These projects demonstrate the significance of international markets for Alp and our success in sustaining long-term relationships with large OEMs.

- **With new models like the Chinese stealth Z-20 and Turkey's General Utility Helicopter, what trends do you see in new helicopter technologies and models?**

As a key instrument for militaries globally, the standard design for helicopters has not changed significantly over the last five decades. The basic flight technologies have remained the same while electronics and power systems have improved. This is slowly changing, with a new generation of radically designed helicopters. New generation helicopters such Sikorsky's X2 can fly higher and/or faster than ever before, with or without a pilot.

- **What role will Alp Aviation play in the future of the Turkish aerospace and defense industry?**

Alp Aviation aims to participate as a design and manufacture partner in indigenous aircraft programs in both military and civilian sectors in Turkey. Alp is prepared to play an important role particularly for landing gears and transmission systems. The company is also investing in niche technologies and best selling military and commercial programs, including newer aircraft programs such as the F-35, Boeing 787, Airbus 380 and P&W NGPF. This helps us maintain a high rate of sales growth, which we expect to be 20-30% annually over the next five to seven years. While 64% of our projects are currently in defense and the remaining 36% commercial, commercial programs are primed for growth. Significant orders from the Turkish Aviation Industry, particularly THY, leading to an increased interest towards Turkish industry from leading OEMs, Alp is expected to enhance its key flight safety products supplier role further as a result of the Turkish Utility Helicopter Program (TUHP) and will also become a spare parts source for the Turkish Armed Forces and Turkish National Police's Sikorsky fleet. Turkey is one of the world's fastest growing countries, whose progress in aerospace and defense makes it not only a market, but a reliable partner for sales, profits, additional capacity, competitive costs and dependable resources. ●



Haluk Bayraktar

●●●
General Manager
BAYKAR

●●● **Baykar began work in the automotive manufacturing business, and has evolved to now manufacture unmanned aerial vehicles (UAVs). Can you please provide us with a brief history of Baykar and elaborate on the evolution of the company?**

Baykar was established in 1984 as an engineering company and sub-contractor to major automotive companies in Turkey. In 2000 the company became interested in guidance and control systems for the aviation industry. UAVs were a relatively new concept in Turkey, and we had to conduct a significant amount of research given the number of complex electronics involved. Discontinuing operations within the automotive industry, Baykar went to the drawing board and concentrated on fully automatic UAV guidance and control systems. The company mainly started with miniature-sized systems and then shifted to bigger systems over the years. Our shift from the automotive industry to the aviation

industry began in 2002, and we delivered the first UAV product—Bayraktar Mini UAS—to the Turkish military five years later in 2007.

Since 2007, Baykar has delivered more than 200 miniature planes to the market. We design the platform, electronics, ground control and components of the UAS. Our team is comprised of young talent, whose dynamic engineers are motivated by work and accomplishments in new and emerging areas. About 75 of our employees are engineers and 45 are technicians with multidisciplinary backgrounds. We also have a research center that employs 70 people. Baykar's products are very successful in Turkey and have been used by the country's military and police. In fact ours is the first UAV in Turkey to be accepted by the military and operated actively. In 2012, we also started exporting the Bayraktar Mini UAS to Qatar's Armed Forces. The plane is built for short-range reconnaissance and surveillance applications. Compared to similar products on the global market, Baykar's product has a very unique system along with advanced technological features.

What are some of the Mini UAS' differentiating features?

The Bayraktar Mini UAS is fully autonomous from takeoff to landing. The plane continuously calculates its store of energy and if its energy is not sufficient to return to the point of takeoff, the plane will automatically return without any user intervention. The plane can fly for up to one hour, and survive many adverse weather conditions. If affected by conditions such as spinning from high winds, the plane is able to recover automatically. The Bayraktar Mini UAS has completed its product life cycle including design and delivery, to training and logistics. The Bayraktar Mini UAS is the first system of its size that the Turkish Military Force is using, and Baykar continues to offer logistics support to the product's end users.

Subsequently, we developed Bayraktar Tactical UAS that can fly at 30,000 feet for up to 30 hours, breaking Turkish national aerospace altitude and endurance records. We delivered the product in 2014 and 2015, and it is currently operational. Our plane utilizes a triple redundant computer system, which is the first in its class worldwide. The advantages are that if the plane

is out of the hanger, it can travel to the runway by itself. The plane can also land, brake, and park completely autonomously. Furthermore, the UAV's surveillance view is of a very high quality both during the day and at night.

Turkey is currently focusing on building new aviation technologies and hence the government is heavily supporting the development of UAV systems. Accordingly, they have put forth a criterion to determine what percentage of a given system is indigenous. 93% of Baykar's tactical UAV project is indigenous, which is significantly high. We are able to achieve this percentage due to the fact that all critical electronic subsystems and software used in our products are developed in-house.

What is Baykar's vision and goals for the next few years?

With regards to the current global UAV market, 85% is comprised of military forces and only 15% of sales go towards civil use. The reason for this is that the military is not bound by regulatory limitations in terms of UAV use. We have to aim to develop new innovations as opposed to following others' footsteps. Within the UAV industry, Turkey is able to compete at a global level. While our main focus today is the Turkish government, Baykar has goals to operate outside of the country. Our tactical UAV is still very new on the market and we would like to focus all our attention on delivering the best possible products to our own country. The government is committed to growing Turkey's UAV industry, and since 2004 has been following a new indigenous development model. UAVs are one of the main development areas included in the model.

Over the next few years we will focus on establishing our tactical UAV unit in the market and increasing sales. There are a significant number of opportunities for us within our reconnaissance and surveillance business that we would like to embrace. Baykar will also continue conducting research and development in order to develop bigger and better products. •



Aziz Sipahi

VESTEL DEFENSE AND AYESAS

●●● Can you please introduce us to Vestel Defence and AYESAS?

Vestel Defence and AYESAS are sister companies, both belonging to the Zorlu Group. Vestel Defence is wholly owned by the Turkish Zorlu Group, while AYESAS is a joint venture with the American company L-3 Communications, owning 40% of the company. Vestel Defence is a platforms manufacturer, focused on the production of UAVs, and AYESAS is a systems supplier of avionics and electronics. Aziz Sipahi heads both organizations from their headquarters in Ankara, Turkey.

Turkey has demands for armed as well as all weather surveillance UAVs. Is Vestel Defence working on any new projects to meet these needs?

Vestel Defence has developed indigenous UAV systems in three categories since the company's establishment 11 years ago. These include the mini UAV EFE, a tacti-

cal UAV KARAYEL, and training aircraft BORA. In order to develop different UAV systems such as armed or rotary, in-house technology is required. Our advantage both as a company and country is that the domestic UAV field has matured significantly enough to design and develop almost everything indigenously. While we purchase select components from foreign markets, the complete design, software and development is performed internally.

As per the needs of the user, we have already started to make the necessary modifications for the armed UAV and, although the details are not shared with the public at this stage, an armed version of KARAYEL is almost ready. Currently, KARAYEL UAV's are actively used by the Turkish Armed Forces for surveillance purposes across Turkey.

Vestel Defence is currently leading other confidential indigenous development UAV programs for different purposes. We are working with Turkish sub-system manufacturers and trying to make use of locally available UAV systems on UAV's as much as possible.

UAV technology is relatively new, hence UAV regulations, including those concerning UAV flight within civil air zones, are being developed now in Turkey, Europe, and the United States. However Vestel Defence has an important advantage: NATO standards. The NATO 4671 'airworthiness' standard has to be met in order for UAVs to fly over civilian zones, and our Karayel UAV is one of very few UAVs that are designed according to this standard.

What other challenges prevent the successful development and sale of UAVs?

There is one primary issue: payloads. Only select payloads, which are critical for UAVs, are manufactured in Turkey. And as per U.S. specifications, Turkey is obliged to import. Otherwise, most systems are ours, or can be purchased from other countries. In the meantime, Turkish company ASELSAN is developing payload technology, and we hope that they succeed.

On the other end of the spectrum, AYESAS is a systems supplier of avionics. Please introduce us to the company and its presence in the Turkish market.

AYESAS does not manufacture any kind of land, air or sea platform, but rather supplies electronic systems for such platforms,

working mainly in command and control and avionics. The company was established 25 years ago in 1990, making it one of the oldest private defense companies in Turkey. We are pioneers in avionics software, and continue to maintain our position as market leaders in this field. AYESAS is the only company in Turkey to develop more than 18 to 20 software systems that are already FAA-approved. We are also the primary avionics supplier for Turkish platform makers such as TAI and ASELSAN, but work mainly for American civilian aerospace companies.

Apart from avionics AYESAS is an electronics manufacturer, and the first company in the world to secure a software share outside the United States within the F35 program. We are still the only company in Turkey to have a software, electronic manufacturing, and design share in the program. We also provide two main systems for the F35: a missile remote interface unit (MRIU) and panoramic cockpit display electronic modules. AYESAS is manufacturing electronic cards and modules for both sub systems for F35 aircrafts as a sole source. We also work with Boeing, Lockheed Martin, Sikorsky and Airbus.

In the field of command and control, AYESAS gained its expertise through a large Turkish air defense mobile radar complexes program in 1990s, for which we were the main contractor. Today we perform command and control software and hardware design, manufacturing and integration.

What goals would you like both Vestel Defence and AYESAS to realize in the next three to five years?

Our goal is for Vestel Defence to become one of the leading UAV suppliers in the region. The interest that we continue to receive from Middle Eastern, Eastern European and African companies is incredibly high. We are engaged in negotiations with some of those countries, and can achieve this goal within the next three to five years. For AYESAS, we would like to firstly maintain our competitive position in the market with respect to the main global players, and to improve our business volume with those companies. Secondly, as per our long-term strategic plan, we plan to leverage our expertise and enter the healthcare market, where quality and technology expectations are similar. ●



K. Nail Kurt

General Manager, CEO
FNSS DEFENSE SYSTEMS

- **FNSS Defense Systems was established in 1988 as a result of a large and symbolic SSM contract for the production of 1,698 armed combat vehicles (ACV-15) for the Turkish Armed Forces. Since then, FNSS has evolved to become one of Turkey's most established and reputable defense companies. How has the company grown to secure its current market position?**

There are numerous reasons for FNSS' growth. Firstly, the firm's partners have not looked at this joint venture as a one-time opportunity. Both partners have foreseen the successes of such a young, dynamic company and supported it entirely since its formation. The initial hybrid management team was very professional and laid down a corporate foundation that was strong, professional and resilient.

The Turkish team that took over management from the American team in the mid 1990s was visionary, modest and confident. Together with the company staff,

the team formed a forward-looking private Turkish company. Their vision lay the foundation that FNSS is now building upon, inspiring a competitive Turkish land system company on the path towards becoming one of the leading companies in the world.

FNSS' CEO and top management have always utilized modern management principles and relied on top-tier young personnel. FNSS' CEO is not only a leader of the company, but also a leader of the Turkish defense industry, whose positioning lends a great deal of strength to the company. FNSS' personnel are selected from top-notch university graduates, and are proud to be part of such a fast-growing company. With regards to product offering, FNSS evolved from a licensed product manufacturing company to designing and developing its own combat vehicles and weapon systems. FNSS entered the wheeled-vehicle market with its own products, a decision that proved to be very successful. Currently, FNSS' vast portfolio of indigenous products ranges from a family of tracked vehicles called Kaplan and WAV FoVs called PARS, to weapon systems, special engineering vehicles, and ILS.

What are some specific technological advantages that make FNSS' products attractive in the global marketplace? Given that the average rate of indigenous production for the Turkish Armed Forces inventory is 50%, what percentage of your technologies have been produced indigenously?

Since 1993, FNSS' products have employed local Turkish systems that comprise about 60% to 70% of its vehicles. FNSS' marketing philosophy is to adapt to the technologies that our customers are asking for. This flexibility in our offering provides comfort to the procurement authorities, allowing them to select sub systems from a variety of sources.

The power pack for example has been an issue in Turkey since FNSS began indigenous production in the country. The procurement authorities, however, are now planning to establish such capabilities in Turkey, which will immediately enhance FNSS's position to offer products with Turkish power packs.

FNSS PARS vehicle family has select features that do not exist in competing

vehicles in its class. Can you discuss some of these features?

FNSS has chosen to offer products that meet the demands of the battlefield, instead of following traditional designs. PARS, for example, is amphibious. This feature gives the vehicle the advantage of crossing inland waters without a need for a transporting medium. A very important difference is also the cockpit design, which provides the driver and the soldier sitting by him with the comforts of a modern truck, such as a greater visibility advantage over the operation area while still under protection. The PARS FoV driver cockpit has twice the volume that its competitor vehicles offer.

Unlike its competitors, the PARS driver does not have to drive at an open-hatch position under any climatic conditions. This immediately impacts the driver positively as he is not affected by the existing threats outside the vehicle. Thanks to its all-wheel steering mechanism, the vehicle does have a very short turn radius. In fact PARS FoV has the shortest turning radius relative to its competitors. This is quite advantageous in urban fighting, where sharp turns in narrow streets are necessary. If selected by the customer, the ride-height system gives the driver the ability to adjust the height and inclination of the vehicle according to the geology and threats of the operational area. Furthermore, if required by the customer, a hydropneumatic suspension system provides different ride characteristics that some customers might find advantageous in their operations.

What does Turkey require to improve its positioning in the global defense market and achieve its 2023 targets? How is FNSS playing a role in this strategic national plan, and where do you envision the company in the next three to five years?

Turkey will continuously improve its position in the global defense market by increasing its offering of indigenous products. Turks are progressively learning how to improve their exports. In this respect, FNSS is already a champion in the export market and such performance will continue, as FNSS is expecting to capture major upcoming local land platform contracts. By 2018, the company plans to earn \$500 million income annually. ●

INNOVATIVE AND PROGRESSIVE SOLUTIONS IN GLOBAL DEFENCE





Atilla Çiftçigüzeli

●●●
CEO
ISTANBUL SHIPYARD

- **Istanbul Shipyard has a 35-year history, though within the last 12 years has upgraded its infrastructure after being acquired by SNR Holdings. Please provide a brief introduction to Istanbul Shipyard's history.**

The shipyard was founded in the 1980s but after being acquired by SNR Holding in 2003, it was renamed Istanbul Shipyard. Following the acquisition Istanbul Shipyard began a massive reconstruction process to upgrade our facilities and capabilities. The work on naval projects started in 2007 with our modernization of four SAR 35 Turkish Coast Guard Boats. After that, the shipyard completed five Romanian Border Police River Station Boats and then was awarded a contract by the Undersecretariat for Defense Industries for the submarine rescue mother ship (MoShip), rescue and towing ships (RAT ships), and seismic research vessel projects. Today Istanbul Shipyard has all the necessary certificates including facility and personnel security clearance

certificates for national and NATO standards with the capacity to build both commercial and naval vessels. The shipyard area has a capacity of processing 25,500 tons of metal per year, as well as six slipways for the new building projects. It is capable of providing repair and maintenance services for up to 14 vessels simultaneously, and has two floating docks, three piers, and an extensive wharf area.

SNR Holdings has several companies including Seft Ship Design, ABS Steel, ABS PV, Şener Petrol Shipping and SNR Shipyard. How does Istanbul Shipyard collaborate and work within this group of companies?

SNR Holding's subsidiary companies provide a complementary system where vessels constructed by Istanbul Shipyard will be chartered by Şener Petrol Shipping, and the feedback from their experience will go into building new and better tankers. Another subsidiary, Seft Ship Design, with 45 engineers provides the brainpower for designing new vessels. Istanbul Shipyard's spin-off, research and development company, MILPER propeller technology, invests in propulsion technology development. There is a high level of design and manufacturing that go into MILPER's propellers which can transfer 95% to 98% of the engine's power to thrust resulting in a better speed to fuel consumption ratio. MILPER also uses a seven-axis system for grinding its propellers leading to a high quality product that can be used in all segments of the maritime industry from small boats to large naval vessels. Though the management of these companies is independent, the combined abilities of SNR Holding's subsidiary companies provides many opportunities for synergy in the servicing the full lifecycle of our vessels providing long term benefits.

Istanbul Shipyard began its work in the defense sector in 2007 with the SAR-35 modernization project for the Turkish coast guard. What prompted Istanbul Shipyard to work in the defense sector?

Istanbul Shipyard targeted naval projects because of their high visibility and technical difficulty. Through this effort Istanbul Shipyard has improved its technological capability, helping us to produce higher quality advanced vessels. For example, two of the major naval projects, the MoShip and RAT ships, have had American and British

standards applied that include factory testing, harbor testing, a two-to-seven month period of sea acceptance testing, as well as system installation and integration. These high standards and tests mean that roughly 8% of Turkey's shipyards are eligible for projects like these.

The naval sector also presents a global opportunity for the company to build patrol craft for safeguarding offshore oil and gas platforms from security threats. According to recent research, roughly 2,000 patrol boats are required to safeguard offshore facilities globally. For example, Istanbul Shipyard entered the Romanian market with the SNR class patrol boat and has renovated Turkish Coast Guard search and rescue vessels. Building warships for Turkey does not yield substantial profits due to the very high requirements of the navy but it does give the company a reputation for naval work, which introduces new opportunities to do naval work for other countries.

Both the ALEMDAR and the ISIN & AKIN ships, the MoShip and RAT Ships, had significant offsets applied to their contracts. What strengths and expertise does Turkey have in the shipbuilding industry?

Turkey's shipbuilding sector developed considerably between 2004 and 2008, but the global financial crisis affected world trade and the shipbuilding sector. To rekindle the entrepreneurial vigor, the Turkish government strategically invested in the naval sector for the domestic production of vessels for the Turkish navy. During this period high budget projects such as the MoShip, the Rat ships, landing ships, tank landing craft, landing platform docks, tankers with replenishment at sea capabilities and Coast Guard boats have all been commissioned by the government with more projects forthcoming.

Where do you see Istanbul Shipyard in the next three to five years?

Building on the experience and reputation gained from the construction of naval ships, Istanbul Shipyard plans to increase exports and international visibility. The vessels that Istanbul Shipyard has built represent some of the most cutting-edge technology that the industry has to offer. Building off of this experience Istanbul Shipyard aims to be a leading actor in Turkey's shipbuilding sector. •



Izzet Artunc

Chairman & Director General
**MECHANICAL AND CHEMICAL
 INDUSTRY CORP. (MKE)**

- **MKE has an impressively long history beginning with Sultan Mehmet II after the conquest of Istanbul. Please provide a brief history of the firm in the modern era, starting from the early 2000s.**

MKE has a very rich history that dates back to the Ottoman empire in the 15th century. When the empire dissolved, the company's machinery and manpower were transferred to Ankara, which served as the cradle of our institutions during the independence war. After the war, MKE became the pioneer for the industrialization of the Republic of Turkey, as the organization was responsible for many of the first industrial institutions of the republic. Most factories that are currently in operation were established from the mid 1920s onwards, after which time Turkey has been led by private industrialization. MKE was initially involved with many economic activities but currently focuses all its attention on military production. The company operates 10 different

factories that are mainly delegated for military purposes, and has completed over 200 research and development (R&D) projects. Currently, 117 R&D projects are being carried out with a budget of nearly 260 million Turkish lira. MKE is proud to be the leading company in the Turkish defense industry.

In 2013, MKE's exports totaled \$38 million. How has the company's export strategy evolved since this time?

As a huge institution with about 5,500 employees across 10 factories, we cannot only supply our own country's military, making exports necessary. MKE has to be global in scale to make the institution more economic and able to compete in the global market. MKE aims to be competitive in terms of capacity, quality and price.

MKE's exports have grown significantly. At the end of 2015, our exports will total approximately \$96 million, up from \$4 million in 2000. By the year 2023 we hope to achieve a much higher level of exports for which we will need to make substantial investments and focus on training our employees to cultivate a global mentality.

MKE operates within four main areas including ammunitions, rockets, weapons and explosives. Which of these divisions is most important to your business?

All four divisions are equally important to MKE as the areas are interconnected and support each other. Hence we are committed to developing each product group equally. This strategy helps us maintain and increase the number of customers with whom we work, as we can provide them with complete solutions. Depending on global political circumstances, as well as political conditions of the companies to which we export, some business areas might become more significant at certain times. Recently, small ammunition and small arms production has become important as global defense expenditures are leveled. Exports of small arms and ammunition have also become more substantial, as conflict-ridden areas have undeveloped markets and lack the capacity to procure.

MKE recently announced a joint venture with Rheinmetall. Please elaborate on the project and how MKE and Rheinmetall will complement each other.

Rheinmetall is a well-known company in the Western market, and sits at the forefront

of the global defense market. It will be able to support MKE in R&D, and we will both cooperate on the basis of our aspirations to penetrate international markets. The main benefit will likely be the transfer of Rheinmetall's R&D into MKE's production capacity, while Rheinmetall will profit from MKE's large production capabilities.

Turkey has experienced phenomenal growth, and is working to position itself as a key player in the global defense market. What advantages does Turkey have to help reach its ambitious 2023 goals?

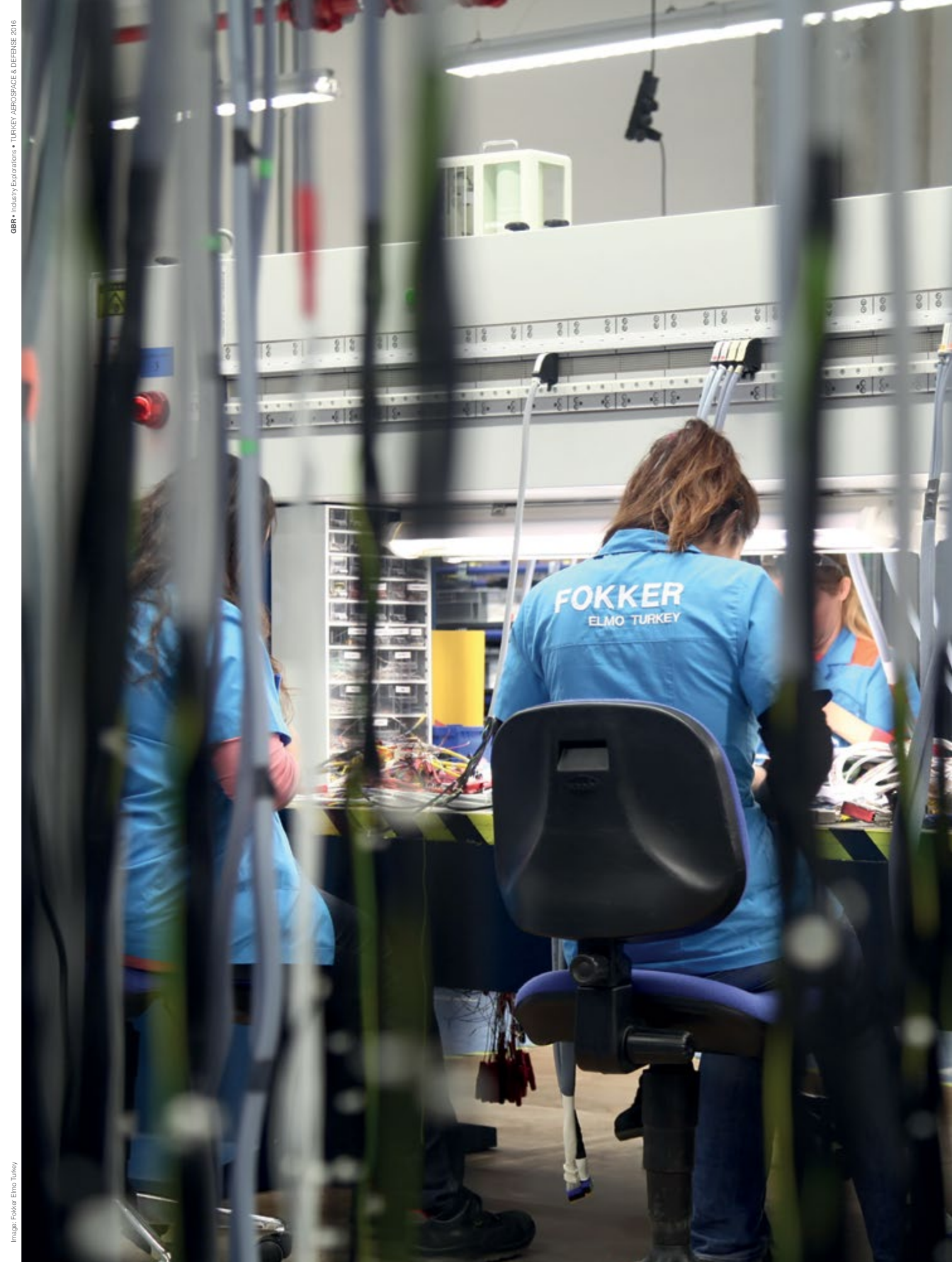
Turkey's main advantage is that the country has high motivations compared to Western countries. Our industries are eager to grow and there is a huge drive for success. Turkey has invested heavily in its human capital and a significant amount of resources have been allocated to education. Turkey currently has about 180 universities and has provided many incentives to attract its younger generation to educate themselves. In recent years, government investments in R&D have also been increased significantly.

What is the perception of Turkey's international brand in the defense market?

MKE is a well-known brand in the international marketplace for its ammunition and cannons. ASELSAN ranks among the top 100 companies in the global market, and Roketsan is also becoming well known. Turkey's eagerness to promote its industry as well as the advantages of cultural relations we have with the markets that we seek to penetrate, result in a significant amount of potential. The Turkish Armed Forces are also our most useful promotion instrument given that they use all the products we export.

Where would you like to see MKE in the next three to five years?

MKE has a rich history. We have evolved into one of the biggest brands in the global market, especially within the ammunition and weapons industry. At MKE, we endeavor to consistently meet global market requirements. We would like to increase exports significantly, and incorporate R&D and design into our production philosophy, include smart ammunition into our production line, and change our production capabilities to be more environmentally friendly. •



FOKKER
ELMO TURKEY



MAKING A DIFFERENCE: MULTINATIONALS IN TURKEY



“GE has a total of eight innovation centers in the world, of which Turkey’s is the newest. The innovation center is a place where GE can collaborate with customers in different industries and derive solutions to our clients’ challenges. The center is also part of GE’s announced \$900 million investment commitment to Turkey.”

- Ismail Sami Özdemir,
Regional General Manager,
Sales Etilah Group/Turkey/Azerbaijan,
GE Aviation

FOREIGN WINDS

International Players in Turkey



The presence of multinational companies is crucial in bolstering developing economies' technological know-how all over the world. In its efforts to build indigenous capabilities, Turkey too has subscribed to coproduction and technology transfer policies. Such directives are especially necessary in the highly specialized and technical aerospace and defense (A&D) industry, and have been fuelled by the government's strategic offset requirements and investment incentive schemes.

"During the process of the establishment of the domestic defense industry infrastructure, for the production of military weapons, vehicles, and ammunition, Turkey preferred to cooperate and co-produce with countries and companies that were seen as the leaders in this sector. This enabled many defense projects like MILGEM (the Turkish warship program), the ALTAY main battle tank, attack helicopter program, ATAK, and several unmanned aerial vehicle (UAV) projects to be successfully executed by our national defense industry," said Investment Support and Promotion Agency of Turkey (ISPAT) president Arda Ermut.

Major players including Boeing, Airbus, ●● BAE Systems, General Electric (GE), Sikorsky Aircraft, Fokker Elmo, PFW Pratt and Whitney, Rolls-Royce, Honeywell and Bodycote have all penetrated the Turkish market, resulting in a dynamic local industry. Many of these international players benefit from Turkey's export-oriented incentives such as VAT exemption, custom-duty exemption, and corporate-tax reduction, as well as social security-premium and interest rate support.

Turkey's most notable international partners include both the world's largest original equipment manufacturers (OEMs), Airbus and Boeing, whose presence has a tremendous impact on the local supply chain.

"Turkey is a huge market for both Airbus and Boeing, who are both selling a large number of aircrafts to the local industry. As Airbus and Boeing cannot simply sell aircraft and have to provide work to the local industry through offsets, local companies will strengthen their positions as aircraft sales increase," said managing director of PFW Aerospace Werner Kuntze.

Both OEMs have developed longstanding relationships with Turkey, resulting in greater business volumes for local and international companies in the country. German company and subsidiary of Airbus, PFW Aerospace, for example, has grown its presence in Turkey by threefold in the last three years due in part to the extensive work it does with Airbus. Boeing too has maintained an important relationship with Turkey since the mid-1940s, and

over the years built its network of local suppliers and partners up to 2,500 people, generating a business volume of more than 1.2 billion USD.

Another strong multinational partnership with Turkey's A&D sector dates back to 1985, when GE made a strategic investment in the country. The world's renowned engine manufacturer entered the Turkish market through a joint venture with local contractor Turkish Aerospace Industries, Inc. (TAI), the Turkish Armed Forces Foundation and the Turkish Aeronautical Association in Eskisehir. The resulting company is known today as Tusaş Engine Industries Inc. (TEI).

"GE Aviation made its first investment in the 1980s in establishing TEI and continued with TTC in 2000. Today TEI is a world class aviation company manufacturing over 700 high-tech, complex parts for 39 military and commercial engine programs and also provides MRO and AIT services for certain military engines regionally. TTC is focused on promoting aviation-related research & development and innovation for our aircraft, marine and

industrial engines throughout their lifecycle with over 350 highly skilled Turkish engineers," said GE Aviation's regional general manager Ismail Sami Özdemir.

GE has announced a \$900-million commitment to Turkey, \$500 million of which has already been invested. The engine giant has also established its eighth Innovation Center in Turkey, as well as an aviation engineering technology center. Most recently, GE worked together with its local partner TEI on the development of its new LEAP engine, helping to grow Turkey's local knowledge base. ●●

Engine rival Rolls-Royce has also made significant strides in Turkey, today holding close to 10% of the total local defense market share. The British power systems manufacturer supplies aero engines to the Turkish Armed Forces, power plants for the A400M and ATAK helicopters, and soon the engine for Turkey's Light Utility Helicopter program. But aside from their commercial endeavors, the firm is investing heavily in Turkey's research and development capabilities. Late last year, Rolls-Royce signed a memorandum of understanding with the scientific and technological research council of Turkey, TÜBİTAK, to establish an Advanced Manufacturing Technology Center (AMTC). The initiative is part of its broader strategy for Turkey that includes building relationships through involvement in Turkey's indigenous programs as well as developing strong local technological capabilities.

"To the extent we are able to, we aim for a designed-in-Turkey,

To the extent we are able to, we aim for a designed-in-Turkey, built-in-Turkey approach, focusing on high-localization content and as much of knowledge transfer as is possible.

*- Patrick Regis,
President,*

Turkey & Central Asia, Rolls-Royce

built-in-Turkey approach, focusing on high-localization content and as much of knowledge transfer as possible,” said president of Rolls-Royce Turkey and Central Asia, Patrick Regis.

In a similar manner, international aerospace pillar Fokker Elmo has contributed its unique electrical wiring expertise to the Turkish market. The Dutch firm has established itself firmly within the Turkish A&D ecosystem, boasting a quarter century old relationship with the country.

“We are continuously adding more capabilities to our Turkish facility and by doing so introducing responsibilities and programs that otherwise would not have the ‘made-in-Turkey’ sign on it, and will further evolve to be able to serve customers directly without assistance of our parent company,” said general manager Mischa Baert.

Fokker Elmo performs specialized development and production of electrical wiring integration systems for various defense projects including the Airbus A400M, Boeing P-8A, Lockheed Martin F35 and AgustaWestland AW 159 and AW 101

●●

During the process of the establishment of the domestic defense industry infrastructure, for the production of military weapons, vehicles, and ammunition, Turkey preferred to cooperate and co-produce with countries and companies that were seen as the leaders in this sector. This enabled many defense projects like MILGEM (the Turkish warship program), the ALTAY main battle tank, attack helicopter program, ATAK, and several unmanned aerial vehicle (UAV) projects to be successfully executed by our national defense industry.

- Arda Ermut,
President,
Investment Support and Promotion
Agency of Turkey (ISPAT)

helicopters. On the commercial side, the firm is beginning work on the Bombardier Cseries and Airbus A330neo.

As Turkey continues to invest in the development of its defense industry in line with its 2023 vision, international A&D players will continue to play a crucial role in its strategy. Having recognized the opportunities the country offers, many multinationals have already been drawn to its borders. “We are by far the largest economy in the region with a huge domestic market, a highly qualified labor pool and an advanced infrastructure. With these traits, Turkey is an excellent location as a manufacturing hub as well as a regional headquarters for international investors looking for new growth markets to tap into or manage their current regional operations,” said Ermut.

Moreover, Turkey’s offset policies and status as a NATO member serve as further incentives for foreign firms to consider entering the market. These factors can promote a favorable mutual exchange for investors and Turks, and help the republic realize its ambitious 2023 vision. ●

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INVESTMENT SUPPORT AND PROMOTION AGENCY OF TURKEY (ISPAT)

●●● The Investment Support and Promotion Agency of Turkey (ISPAT), also known as Invest in Turkey, is the official organization for promoting Turkey's investment opportunities. Please provide a brief introduction to the history of ISPAT and its role in the Turkish economy.

The Investment Support and Promotion Agency of Turkey (ISPAT), established under the Prime Ministry in 2006, unified all the foreign investment-related services into one institution. Catering to the needs of foreign investors looking to do business in Turkey, ISPAT operates with a one-stop-shop formula. From first contact to after-care services, it is present at every stage of an investment project by an international company in Turkey.

To date, the agency has realized many investment projects that created employment, transferred technology, know-how, and raised our exports, all of which contribute to the overall development of our country in

parallel with government policies.

Lately ISPAT has assumed an even more influential role in attracting foreign direct investment, as part of a new deputy prime ministry that is directly responsible for improving Turkey's business and investment environment and coordinating the reform agenda.

As per the reform program, ISPAT will contribute to the strategy and policy making processes of the government, and help tune the investment incentives to better fit our country's needs and become one of the top 10 economies of the world by 2023.

The promotion of Turkey's business opportunities also remains one of ISPAT's core tasks, as a network of country advisors work around the globe to bring the best of our country to the attention of international business circles.

Part of Invest in Turkey's mission is to provide industry overviews and sector reports. Could you provide an overview of the aerospace and defense sector in Turkey? Also, what kind of incentives does ISPAT provide to this sector in Turkey?

Turkey has achieved great success in recent years in the field of aerospace and defense, and today is among the countries with the fastest developing aerospace and defense sectors. Owing to their experience and emphasis on quality, Turkish companies in this sector are developing one project after another, creating products that are competing worldwide, and assuming important roles in international projects. With their qualified human resources and high technology infrastructure, our companies bring global solutions to satisfy many countries' requirements. Turkish companies conduct activities in many critical areas of the aerospace and defense sector such as original design and development, domestic production, modernization and modification, R&D and international projects.

During the process of the establishment of the domestic defense industry infrastructure, Turkey preferred to cooperate and co-produce with countries and companies that were seen as the leaders in this sector. This enabled many defense projects like MILGEM (the Turkish warship program), the ALTAY main battle tank, attack helicopter program, ATAK, and several unmanned aerial vehicle (UAV) projects to be successfully executed by our national defense industry. Nowadays, the Turkish defense industry meets the needs

of our armed forces and plays an effective role in the highly competitive international defense market by developing indigenous products. Turkey's increasing industrial capabilities and competence have pushed the country forward in recent years with home-grown projects such as ANKA (a UAV produced by Turkish Aerospace Industries, TAI), HÜRKUŞ (a tandem two-seat, low-wing, single-engine turboprop developed by TAI), GÖKTÜRK (a high resolution electro-optical satellite), the T70 Turkish Light Utility Helicopter, and the TFX Turkish Jet Fighter Aircraft. Some important subsystems and technology development projects have also been initiated to support such programs. In this regard, we can say that the Turkish defense industry has reached a maturity level in terms of capabilities, quality, and proficiency. Turkey's domestic and overseas market share will increase alongside the completion of the other important national defense projects.

Turkey's investment incentive schemes are mainly based on a regional approach. According to the incentives legislation, Turkey is divided into six different regions where the most developed cities, defined as first region, benefit from the least amount of incentives, while the least developed cities, defined as the sixth region, benefit from the highest amount of incentives.

The sectors to be supported in each region are determined in accordance with regional potential and the scale of the local economy, while the intensity of support varies depending on the level of development in the region. However, some areas that are considered under the priority investment areas (listed in the legislation) can benefit from fifth region incentives regardless of the region where the investment is made. Among these investments areas are: Investments in the defense industry to be made with respect to the project approval received from the Undersecretariat for Defense Industries (SSM), and Investments for the production of items in the high-tech industry segment stipulated in the OECD's definition for technology intensity (production of aviation and space vehicles are also included). Therefore, most production-based investments in the defense, aviation, and aerospace sectors are considered as priority investment areas and can benefit from fifth region incentives.

These incentives include VAT exemption, custom duty exemption, corporate tax reduction, social security premium support (em-

ployer's share), and interest rate support. In addition, if the total fixed investment amount of production of aircraft and spacecraft and/or related parts exceeds 50 million Turkish lira it can also benefit from the large-scale investment incentives scheme.

Increasing exports and reducing imports is a key part of the 2023 aerospace and defense export goals. What export markets does the sector currently export to? Which countries does it import from? What is the projected trajectory for export growth in the aerospace and defense sector?

Over the last decade, different types of export and international cooperation opportunities have emerged for our companies, in parallel with the development of the Turkish aerospace and defense sector. Defense and aviation exports amounted to \$1.85 billion in 2014, and main export areas included the United States. The main export areas were the United States with \$581 million (a 15% decrease compared to 2013), Europe with \$418 million (a 24% increase compared to 2013), and Asia & Africa with a combined \$856 million (a 55% increase compared to 2013). When we look to the export trend in the previous years, there has been an average annual 15% increase in the last seven years. Assuming that this rate of growth continues in the following years, the projected export level is around 6 billion dollars [by 2023]. Turkey has set specific targets to achieve by 2023, the centennial of the Republic. One of the requirements of our vision to become a regional leader and global player is to make our military defense systems more efficient,

deterrent, and modern. Our national defense industry needs to further develop so that our armed forces can maximize their military capabilities.

In that sense, we are working on a new export and international cooperation strategies in order to accelerate growth in this area.

Turkey's 2023 general export target of \$500 billion expects the defense sector to have a share of \$25 billion (5% of overall exports). Furthermore, increased localization will also be a focus for the defense industry. Of Turkey's defense needs, 60% were sourced locally in 2015, up from 25% in 2003.

Turkey has seen positive GDP growth for the last five years. What will be the future growth of the aerospace and defense sector, as well as Turkey's GDP?

The Turkish economy has been growing at an average annual real GDP growth rate of 4.7% over the past 12 years, standing out as one of the fastest growing economies in the world. Turkey will continue to grow, albeit at a moderate rate. The deceleration is mainly caused by the economic slowdown in the global economy, as a result of the recent global financial crisis and the ensuing sovereign debt crisis. Against this backdrop, the IMF expects the Turkish economy to expand by 3.1% in 2015 and 3.6% in 2016 and 2017. The robust economic growth over the past decade has almost doubled the Turkish economy: GDP, at purchasing power parity, increased to \$1.5 trillion in 2014, up from \$800 million in 2004. Similarly in the meantime, per capita GDP reached \$19,610, up from \$12,163.

As the Turkish economy has been growing significantly over the last decade the aerospace and defense sector followed suit, expanding from \$3 billion to over \$5 billion over the last five years.

According to SSM's strategic view, the following issues are primarily important for the defense industry within the context of the plan: achieving maturity in program management, sustainability of the defense industry, and developing technological competence. SSM will focus on endeavors to ensure the sophistication of the defense sector. It will also guide the small and medium-sized enterprises and suppliers present in the defense industry to develop their capabilities related to program management and technology levels.

Nonetheless, endeavors related to design projects that enable growth of technological competence, and studies regarding improvement of R&D activities, will become more important in strengthening the sector. Obtaining a number of critical technologies as a result of these design and R&D activities will increase the number of indigenous products and hence the capability of the industry's competitiveness in the world market. Within the context of the aforementioned strategic plan, the turnover target for the defense industry will be \$8 billion for 2016 with an export target of \$2 billion. Those figures may be easily doubled in 2020 upon the condition that the performance of the activities envisaged under the strategic plan are efficiently followed and that maximum effort is put towards the stimulation of the defense sector. ●

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GE AVIATION

●●● **General Electric (GE) has built a strong relationship with Turkey over many years across a number of sectors. To begin please introduce us to GE Aviation's operations in Turkey's aerospace and defense market.**

GE made its first aviation investment in Turkey in 1985 through a joint venture with Tusaş Engine Industries (TEI) in Eskisehir. Today, TEI is a world-class manufacturing shop delivering over 700 high-tech and complex parts to the commercial and military aerospace sector, and performing military engine maintenance, overhaul, assembly, and testing. Today TEI has more than 1600 employees. This partnership has strengthened Turkey's capability to export aviation parts globally, as export volume has reached \$250 million by the end of 2014.

GE Aviation also established Turkish Technology Center (TTC) in 2000, one of only nine engineering centers of GE worldwide, focused on promoting aviation-related

research and development (R&D) and innovation. Within TTC, we support our aircraft, marine and industrial engines throughout their lifecycle with over 350 highly skilled Turkish engineers. We develop technologies that go into our new or upgraded engine parts, or into our manufacturing/repair shops as a new processes. Teams solve problems on current fleet every day. The center built on an impressive 3X growth in the last five years and more than 2.5 million engineering hours are generated, which is a solid achievement for Turkey's aviation sector know-how.

GE also has large install base on military and commercial engines operated by Turkish Armed Forces and also powers more than 60% of commercial airlines in Turkey.

GE recently established an innovation center in Turkey. How will this impact GE Aviation's overall R&D capabilities in the country?

GE has a total of eight innovation centers in the world, of which Turkey's is the newest. The innovation center is a place where GE can collaborate with customers in different industries and derive solutions to our clients' challenges. The center is also part of GE's announced \$900 million investment commitment to Turkey.

What have been the greatest advantages offered by Turkey to GE Aviation?

GE is a global company operating in 175 countries with more than 300,000 employees inventing the next industrial era to build, move, power and cure the world. We have great talent from all over the world, including the Middle East, who are well educated and knowledgeable about the culture of the region, our customers and their needs. Turkey is a dynamic country with highly skilled and well-educated people. The Turkish economy is also growing quickly, which impacts the aviation industry positively.

GE Aviation has pioneered the development of the best-selling LEAP engine, securing interest from large carriers including Pegasus Airlines. How widely is the new engine being used today? How will greater use of the engine affect the aerospace supply chain?

CFM International—a 50-50 joint venture between GE Aviation and Snecma—manufactures the LEAP engine. CFM Interna-

tional's engines are currently in service and are some of the most widely used engines in the aviation sector, for example on the Boeing 737 and Airbus 320 aircraft. Together with CFM International, GE has developed the next generation in engine technology, the LEAP engine. The engine has composite fan blades that are significantly lighter than metal fan blades and bring additional reliability, saving customers fuel. There are a number of other technologies that GE also integrated into the engine such as lean combustion, a debris rejection system, and a fan mounted accessory gear box, which makes the engine easier to service, lowers maintenance, and reduces operating temperature.

Thus far GE has received approximately 9,500 engine orders on three platforms: Boeing MAX, Airbus NEO, and COMAC. In Turkey, the LEAP engine has already been selected and ordered by Turkish Airlines, Sun Express, and Pegasus for various platforms.

We have suppliers all over the world, are looking at our production rate, and organizing our suppliers to make sure we respond to demand accordingly. Given that LEAP is a fast-selling engine, we are also expanding our supplier network to make sure that we deliver on time to airframers and customers. Recently TEI in Eskisehir became designated as a manufacturing facility for LEAP engine blisks, our latest compressor technology that reduces weight and improves fuel efficiency. This example itself shows expansion of our supply chain.

What is GE's strategic growth plan for its aviation business in Turkey?

In 1948, GE became one of the first foreign industrial investors in Turkey, when we joined hands with Koc Group and Isbank to establish a light bulb factory. During the past 65 years, we have been an integral partner in Turkey's social and economic transformation, and remain committed to supporting the country's economic growth and infrastructure development targets through strong partnerships, localization, and innovation.

GE Aviation made its first investment in the 1980s with TEI and with TTC in 2000. We will continue to invest in both entities in terms of technology, engineering, innovation, and talent development to support growth in Turkey's aviation industry. •



Patrick Regis

●●●
President, Turkey & Central Asia
ROLLS-ROYCE

●●● **With increasing media attention paid to Rolls-Royce's future plans for Turkey, the engine manufacturer is poised to grow. Please provide a brief introduction to your operations in Turkey.**

Turkey represents a strategic market and partner country for Rolls-Royce in the context of all of our business segments including civil aerospace, defense aerospace, marine, power systems and civil nuclear. Our local corporate office was established in 2012 in Istanbul, from which we provide strategy and oversee our business activities in Turkey and Central Asia. We employ 174 people, all of whom are Turkish nationals. Rolls-Royce also has a marine sales and services office in Tuzla, from which our marine services team has completed over 1,000 service jobs for our marine customers, including the Turkish Navy. Under our power system's MTU brand, we have a diesel engine production facility in Hadimkoy along with additional offices focusing on sales, proj-

ect management and services. Our defense and commercial customers have recognized MTU Turkey for the last 25 years.

We are a major supplier of integrated power systems solutions to our Turkish customers, which include: Turkish Airlines, the Undersecretariat for Defense Industries (SSM), Turkish Aerospace Industries (TAI), the Turkish Armed Forces, marine operators and shipyards, and industrial power entities. We are also exploring opportunities to develop supply chain capability as well as research and development capabilities in Turkey. In 2014, we signed a Memorandum of Understanding (MoU) with Aselsan A.S, one of Turkey's leading defense companies, to explore potential collaboration opportunities in the area of engine control systems.

What role does Rolls-Royce want to play in the future development of the Turkish aerospace and defense industry?

One of our key strategic intents is to develop partnerships through indigenous programs, especially in defense. This is a collaborative intent through product co-development activities. To the extent we are able to, we aim for a designed-in-Turkey, built-in-Turkey approach, focusing on high-localization content and as much knowledge transfer as possible. We are open to a risk and revenue sharing partnership where this makes sense. In addition to our engagement in the defense aerospace indigenous programs, we are looking to increase participation in new naval indigenous programs such as MILGEM.

Rolls-Royce's recently signed a MoU with TUBITAK to open an Advanced Manufacturing Technology Center (AMTC). Could you tell us more about the project? How did it start? What type of projects does Rolls-Royce plan to develop at this center?

Most recently, we became the founding member and lead industrial entity in the development of Turkey's AMTC with our Turkish partner TUBITAK. The project is led by Turkey's Ministry of Science, Industry & Technology with the endorsements of the Ministries of Defense, Transportation and Energy. The AMTC is a public-private partnership model, based on a collaborative cross-industry research working culture. It will focus on advanced manufacturing capability development and technology application development in aerospace and will include other industrial sectors such as civil

nuclear over time.

We expect both international OEMs and local Turkish players to become members of this center. The AMTC will be designed to satisfy Turkey's ambition to develop advanced core industrial capabilities around its national indigenous programs. This initiative will help shape the regional supply chain capability for Turkey to meet its future needs of the aerospace industry, amongst others in the region. A public-private partnership model is based on a collaborative cross-industry research working culture that will also include well-known Turkish universities. It will focus on the development of industrial capability across industrial segments in the areas of advanced manufacturing and research.

We will work closely with the Turkish government and industrial partners to establish the AMTC, which will be an integral part of our strategy to build a global network of advanced manufacturing research centers and world-class suppliers. Seven of these centers are already operational around the world in the UK, United States, and Singapore.

In June of 2015, Light Helicopter Turbine Engine Company (LHTEC), a joint venture between Honeywell and Rolls-Royce, signed a MoU with Turkish Aerospace Industries for use of the CT800 engine for the light utility helicopter program. What has been the progress on this deal since June?

On Dec 10 2015, we signed the contract to supply CTS800 turboshaft engines for the Turkish indigenous light utility helicopter (TLUH). The agreement, which confirms an MOU signed at this year's Paris Air Show, consists of a five-year development program to integrate and certify the CTS800-4AT engine model on the TLUH platform. The agreement is expected to result in a production program that will provide helicopters to the local Turkish military and civil market, as well as globally. With the CTS800, operators will benefit from a proven commercial and military propulsion system that expands mission range and payload across both the ATAK and the TLUH platforms, a significant operational advantage given common training and logistics delivery platforms. In addition to the development program, LHTEC plans to industrialize production and maintenance of the engine in Turkey, boosting the Turkish aerospace market by providing local opportunities for manufacturing and depot repair. ●



Mischa Baert

●●●
General Manager

FOKKER ELMO TURKEY

●●● **Fokker boasts a decade-long relationship with Turkey. To begin please introduce us to Fokker's presence in the domestic market, and its evolution throughout the years.**

Fokker Elmo's history within the greater Dutch Fokker Aircraft entity dates back 65 years. Initially being part of an original equipment manufacturer (OEM), the ELectrical MOunting (Elmo) part was already operating as a separate entity within the mother company. Currently that experience, both the OEM perspective and supporting the electrical interconnection system as a supplier, is beneficial to Fokker Elmo in its added value towards its customers. In the end of the 1990s, Fokker Elmo established a low-cost production facility in China, which grew to a now 900+ people operation. Building on this success, combined with the request from the market for a similar approach for defense products, we decided to explore alternative geographical locations for suitable locations.

Given the country's status as a long-term NATO member, its sizeable domestic defense market and offset policies, as well as a young and highly educated workforce, Turkey was the ideal option. Fokker Elmo founded its greenfield operations in Turkey in 2007, and grew its staff to 100 by 2011. Today, we employ approximately 300 employees operating out of our new and custom-built facility in ESBAS, the Free Trade Zone in Izmir. While we began in Turkey solely as a production company controlled out of the Netherlands, today we are surely moving up the responsibility matrix and conducting our own purchasing and manufacturing engineering activities. Fokker Elmo Turkey performs complete production and logistics handling, and has grown into a mature and more independent entity. Last year Fokker was acquired by the British multinational GKN, making us now part of a 56,000+ employee family with locations in more than 30 countries and more than \$11 billion in sales. We are confident the new company structure will boost our presence and performance both internationally and in Turkey.

The electrical wiring system is crucial in an aircraft, and can be compared to the nerve system in a human body. What applications do your products have and in what ways does Fokker Elmo innovate?

Inside of an aircraft is a fine, thin maize of wires, crucial to the well-functioning of all the complex systems. This network of wires occupies almost every part of the aircraft, and damage or malfunction in one can be extremely problematic. The contrast of aerospace with the automotive industry is characterized by much fewer quantities, the highest production programs being about 40 aircrafts per month. For defense, this number drops to one or two, and still often each airplane requiring a unique harness set. In this respect, production is not standardized. In fact, due to the precision and capabilities required Fokker Elmo conducts its own training of all personnel.

With regards to innovation, Fokker Elmo has developed a proprietary IT system that helps us build and maintain a strong link between design and manufacturing. Our system links design to manufacturing information, and helps us to digitally design wiring harnesses together with our customers in their environment. During this process our software always maintains

a perfect configuration, which is crucial in the whole lifetime of an aircraft. We utilize this system across our locations in China, Turkey, the Netherlands, and our latest addition in India.

What are some important trends driving the EWIS market?

New technologies include flat bed wire and fiber optics, structure, and composite integrated wiring, to name a few. Given that the driver in the aerospace sector is weight, the industry is developing various solutions to push more data through less cable. Yet the industry caveat is that all solutions must be proven in reliability and safety, making the sector relatively conservative in its approach. Such a mentality sometimes impedes quick adoption of new trends.

Which sector does Fokker Elmo Turkey primarily work in, defense or commercial? Which is growing in importance?

At present, Fokker Elmo Turkey is predominantly engaged in defense programs. We will begin to work on some commercial programs in 2016, increasing our share of work in this segment. Some current defense programs that we are involved with include: AgustaWestland AW 159 and AW101 helicopters, Airbus A400M, Boeing P-8A, Lockheed Martin F35 and on the commercial side we are starting work on the Bombardier Cseries and Airbus A330neo.

Do you have a final message for our readers about your future plans for the Turkish market?

We are aiming to grow further, especially given our recent progress and underutilized existing capacity. Fokker Elmo is aiming to increase its local Turkish team to 400, as well as to grow its responsibilities. We are continuously adding more capabilities to our Turkish facility and introducing responsibilities and programs that otherwise would not have the 'made in Turkey' stamp, and will further evolve to be able to serve customers directly without assistance from our parent company. Fokker Elmo is looking forward to many programs, including some potentially exciting Turkish work following our successful synergy with GKN. •



Werner Kuntze

Managing Director

PFW AEROSPACE TURKEY

- **PFW Aerospace has a long history dating back to 1913, evolving over time through multiple owners and partnerships. The company's relations with Turkey, however, began in the early 2000s. Please provide a brief history and overview of PFW Aerospace's operations in Izmir.**

PFW Aerospace established its operations in Turkey in 2003 with seven team members. We have been growing steadily since, by the end of 2016 we will have 400 employees and 500 by 2018. Our plant in Izmir is part of PFW's global network of specialized manufacturing plants, which we will continually expand and improve as our revenue grows. In just three years, PFW Aerospace has tripled its size here in Turkey and increased revenue by four or fivefold.

PFW Aerospace in Turkey manufactures complex piping systems, aerostructures and assembly components for Airbus and

Boeing aircrafts. We produce piping of up to 1.5 inches in diameter for water, fuel, wastewater, and pressurized air. To craft these piping systems, PFW Aerospace uses special processes in welding, our metallurgical expertise, and X-rays to examine fittings. Most of the company's aerostructure and assembly component work is conducted in Izmir, and most of the remaining aerostructure work performed at headquarters will be transferred to Turkey in the near future. PFW Aerospace in Turkey currently manufactures flaps, pressure frames, and floor structures.

PFW Aerospace has a strong reputation as a supplier to Airbus and Boeing. In which major projects is PFW Aerospace currently participating?

PFW Aerospace in Izmir works on all Airbus projects including the single aisle series A318, A319, A320 and A321 planes, as well as the A330, A380, A350, and the A400M. PFW Aerospace is owned by Airbus as the majority shareholder, which enables the company to secure contracts for many large-scale projects. PFW Aerospace also has contracts with other companies such as Bombardier and Embraer, for which related operations take place in Germany.

What advantages does Turkey provide over other countries for PFW Aerospace?

In the same manner as many other companies, PFW Aerospace chose to establish its facilities in Turkey over countries like China due to its strategic location, which reduces shipping times. Turkey is proximate to Europe, the destination for both sourcing of materials and receipt of final products. Moreover, all approved material sources for Airbus and Boeing are located in Europe or the United States; there are no sources in Turkey. However, PFW Aerospace works to purchase as much material from Turkey as possible to support its production. A second advantage is Turkey's labor cost, which is significantly lower than that of Europe, providing substantial cost savings.

Turkey is a growing market in regards to the number of both defense and commercial aviation projects. What is your opinion on the future of the Turkish aviation market?

Turkey is a huge market for both Airbus and Boeing, who are both selling a large number of aircrafts to the local aviation industry. As Airbus and Boeing cannot simply sell aircraft and have to provide work to the local industry through offsets, local companies will strengthen their position as aircraft sales increase. At the moment, Turkey's aerospace sector is comprised of only a select few large companies such as Turkish Aerospace Industries Inc. (TAI), Fokker Elmo, Kale Pratt & Whitney, and Kale Aerospace. But offsets along with a host of indigenous projects underway will push the domestic aerospace industry in Turkey forward, a growth trajectory in which PFW Aerospace would certainly like to play a part.

PFW Aerospace's expertise and extensive history has primed the company for future success. What is PFW Aerospace's strategic growth plan for the next three to five years?

PFW Aerospace's expansion is ongoing, and in the next three years we will grow the size of our team from now 300 to 500, as well as increasing the revenue. Due to high supply chain visibility and planning for the next five years, we know exactly how many aircrafts and parts to manufacture for Airbus and Boeing. Even beyond 2020, PFW Aerospace in Turkey will continue to grow as Airbus and Boeing sell more aircrafts. For example, Airbus is increasing its production of the single aisle fleet from 44 aircrafts per month to 50 aircrafts in 2016. From 2017, they will increase that number to 63 planes per month until 2018. Given that these numbers and future delivery plans are clear, PFW Aerospace has been able to invest in its plant accordingly and is prepared to expand its capacity. PFW Aerospace is ready for the future, and to serve all our customers' needs. ●





SECURING THE SUPPLY CHAIN: TURKEY'S SMES



“There is a problem in our defense sector. While there are a number of large-scale companies and small-scale companies, there are no mid-sized companies that can assimilate smaller companies’ capabilities and be integrated to large-scale companies.”

- Fatih Unal,
Managing Director and Member of the Board,
Space and Defense Technologies (SDT)

INTO THE FRAY

The Importance of Sub-Tier Suppliers in the Supply Chain



The bulk of Turkey's defense achievements are attributed to its largest and most prestigious star players, but the bulk of Turkey's Aerospace & Defense (A&D) industry is comprised of small- and medium-sized enterprises (SMEs) that are often overlooked. Over 2,000 SMEs are operating in Turkey's A&D sector, ranging from OSSA's manufacturing members in Ankara to high technology companies within Teknokent Defense Industry Cluster (TSSK) and Teknopark Istanbul to those making engine parts and aerostructures in Eskisehir and Izmir. As the sector is projected to grow by 4% to 5% annually over the next five years, it will be crucial for Turkey to bolster its lower rung of companies.



Turkey's Tech Savants

Like many other developing economies, Turkey has created an IT and software industry that is internationally competitive. With a pool of educated labor comprised of talented engineers, the state has seized upon its competitive advantage. "Turkey supports its IT sector with many incentives. These include technology development zones and project incentives from institutions like TUBITAK, which are successful not only from a price perspective but in developing competitiveness," said CEO of software development company ICterra, H. Vedat Uslu. Nevertheless, the government needs to continuously support the growth of private companies, such as MilSOFT. The firm is a success story that now focuses its efforts on niche technologies in the areas of C4I and training and simulation, among several others, which are unique to Turkey.

"During the 1990s there were joint ventures in Turkey that engaged in coproduction, through which people got experience building complex defense systems. Indigenous development programs began in the 2000s and many engineers have developed products, platforms, and systems. Hence there is a certain level of experience, but now we are arriving at the second stage in which we have to build the very subsystems underneath the platforms," said managing director and member of the board at Space and Defense Technologies (SDT), Fatih Unal.

While there is plenty of room for growth, companies like ICterra and SDT have both succeeded in filling gaps in local and international markets with their software development and sensor products and capabilities. Other firms like BITES and AEROTIM Engineering are breaking down barriers with their innovations. Technology firm BITES was recently recognized as one of the country's top 50 technology companies for its impressive work with augmented reality (AR), artificial intelligence and software solutions. The applications of AR technology are growing in today's aerospace and defense market, and BITES is one of a few select Turkish companies that are investing in its development. Established as a university spinoff company in ODTÜ Teknokent, AEROTIM Engineering has been selected as a single-source vendor for an FFS Level-D Turkish army helicopter simulator program. It is the only company in the Turkish market that is building simulation software for helicopters and other unconventional flying objects, providing flight dynamics models, control systems, and engine models for simulators.



Cogs in the Wheel

Further down the supply chain, the majority of Turkey's SMEs are engaged in subcontracting or manufacturing of small parts and sub assemblies. While many of these players have successfully secured contracts with large local and international original equipment manufacturers (OEMs) and governments, others remain dependent on offsets.

As Turkey continues to grow, it will be important for the NATO member to promote the competitiveness of its smaller manufacturers. "Offsets are critical for defense and aerospace programs, and while CNK Aerospace is not an offset based company, they do serve as good leverage. However, offsets simply open doors. If companies become dependent on offset driven business, they will never survive in a legitimate business environment," said general manager of parts manufacturer CNK Aerospace, Melih Han Bilgin.

As a result of the company's involvement with Airbus and Boeing commercial aircraft programs, CNK was able to develop the necessary experience to expand its horizons and secure its place within a prestigious international defense program. "There are only six companies in Turkey that are eligible to supply detail parts and mechanical units to the JSF Program and CNK Aerospace is one of them," said Bilgin.

Other Turkish SMEs have established themselves as direct and indirect suppliers to Boeing, Airbus, AgustaWestland, KAI, GE, Sikorsky, Pratt & Whitney, and the U.S. Department of Defense (DoD). Turk-

ish suppliers' attractiveness has stemmed in part from the abundance of skilled low cost labor. This is evident in Eskisehir, where Aycan Aviation has evolved from working with one client to becoming the world's sole supplier for aft shaft parts on high-pressure turbines. "Eskisehir is a strong region for SME growth, allowing us the flexibility to offer lower costs without compromising quality. This is due to the fact that we have excellent access to labour through the Eskisehir Aviation Cluster (ESAC), a local airbase, and nearby universities with reputable civil aviation departments. Local and national governments are also supportive of the aviation industry and collaboration with other SMEs is strong," said chairman of the board at Aycan Aviation, Adnan Canseven.

Many SMEs like CNK Aerospace and Aycan Aviation are looking to capitalize on their strengths and increase their international business. Yet, in order to accomplish this, Turkish companies will have to become more integrated and invest in automation and supply chain management technologies.

...

Filling in the Gaps

Within complex supply chains, each service and piece of equipment plays a vital role in the completion of a given platform or system. In line with the country's indigenous production goals, Turkey's A&D industry is committed to building its own niche capabilities and decreasing its dependence on foreign imports. Turkey's smaller companies have stepped up to the challenge and have successfully managed to meet some of the local demand for specialized services and parts.

For example, local firm Military Battery Industry and Trade Inc. (ASPILSAN) is one of the world's five producers of military batteries and the only one in Turkey. ASPILSAN has met a good portion of the Turkish Armed Forces demand and is striving to expand its reach in the global marketplace. "As the quality of our products is well above world standards and the levels required by military contracts, today all air vehicles in the Turkish Armed Forces are equipped with our batteries. ASPILSAN wants to serve the military's complete energy needs, from small batteries for radios

to larger batteries for aircraft and power units. We are looking to become a one-stop-shop for large and small companies alike," said general manager Ferhat Ozsoy. Similarly, Baturalp-Taylan Ltd. is the sole provider of engine-testing and automation services in Turkey and the single source local supplier of engine test cells to the Turkish Armed Forces. There is significant demand for this niche service, tempting Baturalp-Taylan to look beyond Turkey for new business opportunities.

Other firms such as Bodycote have also recognized unmet needs in Turkey's A&D industry. As a growing market, Turkey does not always meet all international quality standards, especially in the world of heat treatment. In fact, many local players look to service providers outside of Turkey to perform specialized processing. As a result Bodycote came to the Turkish market through a joint venture with local company ISTAS, to bring its expertise as a long standing multinational to the region. "Overall, demand within this sector is growing and Bodycote ISTAS continues to receive new enquiries not only from OEMs like ROKETSAN, ASELSAN and TAI, but also from their suppliers, which are crucial for our business," said vice president Eastern Europe (south) of Bodycote ISTAS, Baris Telseren.

Turkey's smaller A&D players will have to continue stepping up to the plate as the republic works towards increasing local content, promoting import independence and realizing its 2023 vision. The country has recognized the importance of building its own subsystems, which requires increased research and development and a concerted effort on the part of all industry players. "When smaller companies work on subsystem parts for a larger platform they learn about the platform and the technology, and can produce technology faster than big companies. Big companies are integrators, whereas small companies create technological value," explained deputy undersecretary-industry services of the Undersecretariat for Defense Industries (SSM).

In the context of heightening regional conflict and a shifting balance of power, Turkey needs to mobilize all its forces to prove its strength to the world. With targeted government support and investment, Turkish talent may take the world by surprise. •



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ASPILSAN is a Turkish Armed Forces
Foundation company.

www.aspilsan.com



Ferhat Özsoy

General Manager

MILITARY BATTERY INDUSTRY AND TRADE INC. (ASPILSAN)

- ASPILSAN was established in 1981 and has since evolved into one of only five companies in the world that produces military batteries. Please provide a short introduction to the history of the company.

ASPILSAN was founded in 1981 to manufacture cylindrical-type, rechargeable, portable Ni-Cd batteries for the need of Turkish Armed Forces (TAF). By 1984 we started making four types of batteries with the license of German Varta Company. Afterwards, we began producing battery packs for radios as well as for other portable equipment as per the demand of the army. In the meantime, another production line was set up for the manufacture of Ni-Cd aircraft batteries in 1989 and our technical and manufacturing capabilities have improved gradually since then. As the quality of our products is well above world standards and the levels required by military contracts, today all air vehicles in TAF are equipped with our batteries.

ASPILSAN has so far been involved in some defense projects such as F-16, CASA CN-234, SF-260, Sikorsky UH-60, Cougar AS-532, Marconi HF Manpack Radio for the manufacture of batteries as a subcontractor and has fulfilled all its obligations with great success.

So far we have manufactured batteries solely for military aircraft, and our products have been certified by NATO as well as German BWB and French SOPEMEA test centers. ASPILSAN exports its products to many countries across the five continents.

Battery producers often compete on price and quality metrics for the sale of their products. What is ASPILSAN's competitive advantage?

ASPILSAN's quality is what sets us apart from our rivals. An independent investigation of ASPILSAN's customer satisfaction showed that 100% of our customers were satisfied with our products, an impressive testament to ASPILSAN's high quality offering. Although ASPILSAN is affected by price pressures, the company is still able to position itself roughly within the middle of the market in terms of price competitiveness while still delivering best available quality.

Many countries such as the United States have been investing in new ways to improve battery technology. How important is research and development (R&D) to ASPILSAN?

ASPILSAN is working with varied research institutes on two different significant projects to develop a new battery. Due to security restrictions we cannot discuss the full details of the projects, but ASPILSAN is working as a partner with several universities on this new and exciting research.

Facing exorbitant costs, stretched supply lines and stealth requirements, militaries are working to increase the use of batteries. What trends have you seen in the defense battery market?

The average foot soldier carries 30 kilograms (kg) of supplies and five kg of batteries. This is a significant increase from the 1990s when the total weight of batteries in a soldier's pack was half a kg. As new technologies are deployed, soldiers require increased sources of power to use them. To

protect their survivability, mobility, operation sustainability and lethality, batteries need to be lighter, smaller, and easy to use. The challenges presented by greater dependence on mobile battlefield technologies mean that companies like ASPILSAN need to innovate in order to reduce the logistical and physical burdens for the Armed Forces. Another important trend is the demand for more technologically sophisticated batteries with larger energy storage capabilities for mobile military bases. Turkey is a vast country in terms of surface area and its military has a dynamic structure and is constantly on the move around the borders; therefore, mobility of energy is of great importance. It requires portable and reliable energy storage systems for areas where there is little to no infrastructure. Energy needs are often quite high, totaling anywhere from 200 kilowatt hours to 200 megawatt hours of energy. ASPILSAN is planning to meet new demands by manufacturing highly mobile batteries that can go on the grid for quick charging and off it to provide full power to military bases.

New market demands represent a growth opportunity. Where do you see ASPILAN in the next five years?

ASPILSAN wants to serve the military's complete energy needs, from small batteries for radios to larger batteries for aircraft and power units. We are looking to become a one-stop shop for large and small companies alike. To achieve this goal, ASPILSAN has to be ambitious and invest in research for the development of high capability batteries with high energy density levels. We are considering a number of R&D projects that are using new and different chemical combinations to produce these effects. ASPILSAN is also improving its manufacturing capabilities in line with our ambitions for growth in capacity, especially as we expect to receive the European Aviation Safety Agency certification shortly. This certification will allow us to serve the civil aviation market. Furthermore, we are vigorously pursuing contracts in several different industries such as the medical industry, through which we hope to increase exports to Western markets. We expect to be one of the largest players in the battery market within the next five years, at which point ASPILSAN will be the first partner of choice for high-quality military and civilian batteries. •



Ismail Basyigit

●●●
Chairman

MILSOFT SOFTWARE TECHNOLOGIES INC.

●●● **Can you please provide us with a brief introduction to Milsoft and its role as one of Turkey's leading software companies?**

When the defense industry was established in Turkey, software played an important role in initial policies. The Turkish Armed Forces adopted a directive that required gaining software capabilities of the defense systems that Turkey was acquiring. To contribute to the policy, Milsoft was established in 1998 with the aim to develop software in accordance with the highest level of international standards applicable to defense companies. The goal was also to develop its own indigenous technologies that would enable the company to be independent. Milsoft wanted to be competitive in global markets, which also required an effective management infrastructure within the company.

Milsoft worked towards obtaining certifications for international quality standards and earned ISO 9001 certification in 1999. In 2000 we received NATO AQAP 150 certification,

which is now NATO AQAP 2210. Milsoft became CMMI level 3 certified in 2002 and obtained level 5 certification in 2005. This made Milsoft the first defense company to obtain level 5 CMMI certification in Europe and today remains the only company in Turkey with this certification. Milsoft's certifications and portfolio of work with foreign companies is proof that we can work according to best international standards.

The company's second goal was to develop its own indigenous technologies in line with future potential software requirements of the Turkish Armed Forces and the global market. The Scientific and Technological Research Council of Turkey (TÜBİTAK) provides good incentives for research and development (R&D) projects that are innovative and have commercial potential in the global market, and approved all of the R&D projects that Milsoft initiated. To date we have received about \$20 million from TÜBİTAK as grant money, which enabled us to develop technologies and demonstrate our capabilities to international customers. Before Milsoft received contracts from the Turkish government in 2004, we proved ourselves in the international market, securing business from the United States, Germany and Israel.

Can you elaborate on Milsoft's facilities and the company's key capabilities?

Milsoft initially worked as a guest in another facility, only establishing its own facility in 2005 in Ankara. We also have a facility in Teknopark Istanbul, as we work for the Turkish navy in the shipyards located near the facility. Some of our R&D projects are also developed at the Teknopark Istanbul facility. Lastly, Milsoft saw ample business potential in the US and established a Milsoft owned company there to help us realize that potential. One of Milsoft's key capabilities is command and control systems. The company developed its own IT infrastructures and command control systems. We provided the entire command control system software for the Turkish coast guard search and rescue ships. For this project, we sub-contracted to ASLESAN who provided all the electronics.

Another key capability of the company is the development of tactical data links. We developed link 11 and 16 that are operational in Turkish Perry Class Frigates and two operational naval ships. In these two ships, Milsoft also provided command control functionality that is directly linked to tactical data link processes.

When Turkey procured Heron unmanned aerial vehicles (UAVs) from Israel, we provided the transportable image exploitation system (TIES). The information received from the UAV was processed and the information made available to operational users by Milsoft. We not only provided the software, but all the hardware within the TIES shelter. We are also providing image exploitation capabilities as well as ground control stations for Anka UAVs.

What does Milsoft do as an innovator that differentiates the company from its competitors?

Milsoft's main focus is to be innovative and develop technologies that have not been done by any competitors. We invest heavily in R&D and try to gauge future requirements of the industry. Differentiating us further are our latest IT technologies that we use to implement our defense software solutions. We are also using our own IT infrastructure to develop defense systems. Using the same infrastructure to develop all our capabilities enables us to make the system interoperable, which is an important aspect for defense forces. Milsoft is continuously following IT technologies trends and defense software requirements and thus continuously transforming its capabilities to develop new systems using the latest approaches.

How are Milsoft's interests divided between different international markets?

Milsoft provides its capabilities to Turkish government-affiliated companies or directly to international main contractors. More than 50% of its revenue comes from international markets. Our biggest international customers are Alenia in Italy, to which we provide link 16 capabilities, and HTW in Germany who utilizes our link 11 and link 22 capabilities. Milsoft developed and delivered a Navy Information Exchange System to the Pakistan Navy. We have also submitted many proposals for various programs in different continents that are under review.

Do you have a final message for our international readership?

Milsoft has established capabilities in different critical defense areas, and in the future are aiming to incubate all capabilities in one system. Our goal is always to make our processes more effective. The quality of our products and compliance with international standards are important to the company. ●



Ihsan Yusuf Akbuğa

●●● International Business Development Director

BITES AEROSPACE & DEFENSE AND TRADE INC.

Deloitte has recently recognized BITES as one of the top 50 technology companies in Turkey. What is BITES's competitive advantage?

Firstly, BITES is investing heavily in innovation. While we may not be a large systems integration company, we play a different role. We discover large innovation areas such as big data, augmented reality (AR), and artificial intelligence, and develop software solutions accordingly. We are not hardware producers, but rather provide software solutions using an ecosystem of hardware providers. BITES has strategically positioned itself as the software intensive system integration partner. Secondly, we are a committed team. When we sign a contract we deliver on time, and receive a high level of customer satisfaction. We bring long-term returns to the customer, and our brand has been recognized in line with these expectations.

As a company at the forefront of AR technology, could you provide more detail about the applications of such technology within aerospace and defense for our readers?

AR technology is most easily explained with a practical illustration. For example, BITES worked with armored vehicle manufacturer FNSS to find solutions to common situational awareness problems faced by the task force in the armored vehicle. The driver, commander, and task force all have very low situational awareness when they are inside the vehicle, given that it is a closed environment without windows. To enhance situational awareness, BITES has developed an application called 'Eye of the Tiger' that uses smart glass technology and utilizes sensors placed outside the vehicle. This allows for a 360-degree "through the armor" view of surroundings, providing the crew with a clear constructed view from inside the vehicle of the battlefield with augmented information.

Will AR technology have additional applications in aerospace and aviation projects?

AR technology can certainly be applied in aerospace. The Turkish Armed Forces and the government are investing in indigenous aviation programs that have the potential for the use of AR technologies. Furthermore, AR technology can also be applied to forward observers and unmanned vehicle operation systems. AR technology is the biggest

growth area in the market today, as it has many promising military and non-military applications. The military is already utilizing AR technology, and hence we are investing in this area, both to secure a return and to enhance our simulation and training products.

BITES has provided solutions to customers in Europe, Asia and the Middle East. How committed are you to expanding more internationally?

Expanding internationally is one of BITES' targets, and we have always cooperated closely with the Undersecretariat for Defense Industries (SSM) and the ministry of defense on the subject of export markets. We utilize two approaches to achieving this, the first of which is business-to-business. Competition, quality, cost-efficiency, and a very capable task force lie at the core of our company. We have competitive labor costs relative to the western world allowing us to do business with U.S. and European defense markets. Offsets are also still strong in the Turkish market, and there are many that need to be completed. Our second approach is to do business with the Middle East, North Africa, and Turkic Republics where we have very strong government-to-government (G2G) relations. Just this year we signed a contract with Airbus Defense & Space for the virtual visualization content for one of their ground vehicle simulator solutions. However, in the defense market, G2G relations are an important factor when it comes to obtaining export approvals. We try to always take part in government meetings that address G2G issues, to better understand their priorities and the markets we can serve.

Where would you like to see BITES in the next 3-5 years?

BITES has set strategic targets, and specifically two objectives for 2015. We would like to increase our R&D investments, especially in AR, and to expand our international business. This year our export sales have increased considerably and we are looking to sustain this growth. Additionally, we aim to be one of the most successful defense companies in Turkey. In today's world a relatively unknown technology company has the potential to become enormously valuable in the short term, through innovation. We will continue our efforts and investments in research and development to build our brand as a strong Turkish defense company. •

●●● Please introduce us to BITES and provide us with a brief historical perspective of the company.

BITES began as a startup in Istanbul in 2001. Initially we served civilian markets, specifically the digital broadcasting industry, but in 2004, our strong software development capabilities, coupled with increasing demand in the defense and aerospace industry, led us to move our headquarters to Ankara. The industry was booming at the time and Turkey's government decided to support a number of defense and aerospace projects and programs. One of our very first projects was a tank-driving virtual simulation application. Subsequently, we developed other military IT programs such as training management information systems to operate training facilities. After initial military developments we also continued penetrating the civilian market, specifically in the field of web based training technologies. Today Bites serves both sectors.



H. Vedat Uslu

●●●
CEO

ICTERRA INFORMATION AND COMMUNICATION TECHNOLOGIES

- **ICTerra has an interesting history that begins with the international giant, Siemens. Please walk us through the company's evolution.**

ICTerra has a unique story, with roots as a research and development (R&D) department within Siemens Turkey. After 21 years as Siemens' global R&D partner, ICTerra evolved into a completely Turkish company owned by myself. We converted the company's team into a standalone company that today works domestically and internationally. During the company's early days in 2013, ICTerra only worked in the international market, exporting 100% of its products mainly to Germany. At this time we found that our competencies and experience in the software field were valuable to the aerospace and defense sector, and hence we decided to focus on this sector domestically as a first step. ICTerra has since started to establish relationships with Turkey's leading aerospace and defense

players, positioning as a software house for large systems and platform projects. With its partners, ICTerra will be able to grow its expertise in this area, and abroad, where we are looking to market our software R&D services. Since 2013 we have grown by 70%, which is an excellent growth rate given the current global market, providing us with the motivation to continue excelling.

ICTerra offers high-quality, value-added information technology (IT) solutions and consulting services. Can you compare your service offering to those of other companies in the field?

In Turkey, ICTerra is able to differentiate itself due to its extensive experience with international projects. ICTerra has been active over the last 25 years with large-scale and complex multinational projects involving 100 to 200 people. The company is used to working with different cultures, which is especially useful for defense projects for which we have to collaborate with companies in many other countries. For example, ICTerra works on satellite, command and control, helicopter and aerospace projects for large platform integrators like Aselsan and international defense organizations. Because of this we have developed a high level of understanding of the world, which is greatly appreciated by our customers.

What role does ICTerra play in the aerospace and defense industry?

In the next fifteen years Turkey's defense companies and institutions will engage in very important projects, of which aerospace has become a high priority. ICTerra wants to establish its role in these new projects, especially since today's platforms are essentially platforms running software. Platform development contracts will last at least for 10 years, but software will have longer production cycles because future development and modernization of these platforms will stem from software. Together with our partners and foreign original equipment manufacturers (OEMs) such as Sikorsky and Airbus, ICTerra will be able to grow its expertise in this area. In the medium term (10 or 15 years for defense companies) software companies working in aerospace and defense will find good opportunities not only within Turkey, but in foreign markets as well.

R&D is crucial for future innovation. What support mechanisms are available to software companies working heavily in research and development?

Turkey is a unique country in that it supports the country's IT sector with many incentives. As part of Turkey's 2023 goals for the centenary of the republic, the government wants to realize numerous industrial breakthroughs. IT has been named as an industry with great potential in Turkey, and in order to grow that potential the government has formulated incentives to support it. These include incentives such as technology development zones and project incentives from institutions like TUBITAK, which are successful not only from a price perspective but in developing competitiveness. Such initiatives are future oriented and help build capabilities in aerospace, defense, and corporate sectors. Software companies are cost sensitive and often cannot finance R&D activities independently, and such incentives are useful. Yet more government support is needed to promote Turkey's IT sector internationally.

ICTerra has ambitious targets to increase its 2015 total business volume to twice its current level and to place among the top five domestic companies engaged in software exports. What strategy have you outlined to achieve these targets?

Last year ICTerra ranked sixth for software exports in Turkey. While this rank is high, export volumes are depressed mainly due to high domestic demand. As the supply of software in Turkey increases, demand will become more stable allowing us to offer more services to the foreign market. ICTerra would like to enlarge its footprint in the defense sector especially in communications and aerospace related areas. Moreover, we want to be a reliable partner for platform integrators and establish ourselves as the go-to software house for the defense sector. Our vision is for half of our business to be international and the other half domestic. Domestically we expect more than half of our business to be within aerospace and defense. At the moment Turkey is in an incubation phase in aerospace but, as the industry grows, ICTerra will grow with it. ●

Adnan Canseven



●●●
Chairman of the Board
Aycan AVIATION

- **Aycan Aviation boasts 18 years of experience in the aerospace sector and is positioned for further expansion. To begin please provide an introduction to Aycan Aviation and its operations.**

Aycan Aviation was founded in 1997 with a focus on aircraft engine components manufacturing. Over the years we have grown to a size of 65 employees and introduced over 300 complex tight tolerance parts to the aviation industry. Aycan Aviation began with contracts from Tusas Engine Industries (TEI) and has since grown its customer base significantly to directly supply Bucher, Alp Aviation, Turkish Aerospace Industries (TAI), and Roketsan. It also indirectly supplies Airbus, Boeing, Agusta-Westland, KAI, GE, Sikorsky, and Pratt & Whitney.

The company is also an approved supplier for Airbus and Safran Tech Space. The company's capabilities include precision machining, reverse engineering, fixture, tool and die design, fluorescent penetration inspection, 3D modeling, and CAD/CAM operation. Aycan Aviation is adding new competencies to better serve our customers and is looking to offer our services internationally. We are a customer-focused company, which means not only do we seek success for ourselves but also for our customers and suppliers. We attract the industry's top customers by providing high quality products on time. Aycan Aviation is also committed to attracting reputable suppliers and solution partners early in the process, helping them to grow with us and in turn becoming their strategic partners in the development of their products and processes.

Aycan Aviation has direct insight into the local environment for small and medium-sized enterprises (SMEs) after years of working in Eskisehir. How would you characterize this environment in Eskisehir?

In general, the Turkish industry is facing challenges due to exchange rate fluctuations. Nevertheless, Eskisehir is a strong region for SME growth, allowing us the flexibility to offer lower costs without compromising quality. This is due to the fact that we have excellent access to labor through the Eskisehir Aviation Cluster (ESAC), a local airbase, and nearby universities with reputable civil aviation departments. Local and national governments are also supportive of the aviation industry and collaboration with other SMEs is strong. Aycan Aviation for example has signed a strategic partnership with four other critical parts manufacturers to complement our production capabilities. •

Melih Han Bilgin



●●●
General Manager
CNK AEROSPACE

- **Please introduce us to CNK Aerospace and your two main lines of business: CNK Defense and CNK Aerospace.**

CNK was founded in 2004 as a software development company. We evolved into the aerospace manufacturing business when we began manufacturing structural parts for the AB139 Bell Helicopter program. Machines used in aerospace manufacturing require complex software applications, a competency that lies at the very foundation of CNK. Hence, this was the trigger for our entrance into the business, when our customers began asking us to produce parts. CNK has gotten more

involved in the industry over the years, investing more in machining and developing relationships with Boeing and Airbus, specifically in the context of their single aisle aircrafts: 737 and A320. These programs are the most commercially valuable of two giant, world-class customers. By getting involved in both, CNK has developed an ability to further invest and venture into JSF military programs. We have been manufacturing large-scale structural parts, including the fuselage, for JSF for many years under a U.S. government license. There are only six companies in Turkey (a JSF partner country) that are eligible to supply detail parts and mechanical units to the JSF program, and CNK Aerospace is one of them.

Aerospace manufacturing propelled us to the cutting edge of the manufacturing business and helped us impress defense customers with our superior quality and capabilities. Defense clients came knocking on our door, compelling us to enter the sector. Yet the structures for aerospace and defense manufacturing are distinct, so we have developed two branches in the company. CNK's major business remains in aerospace, while defense is secondary. Today, our core competency is complex manufacturing for aerospace and defense.

What vision would you like to realize within the next three to five years for CNK Aerospace?

Within five years the company's total revenue should equal \$50 million per year. CNK Aerospace is growing its aerospace manufacturing and assembly capabilities, but we would also like to grow significantly in foreign markets. In five years time we hope to generate 80% of our sales from business abroad, and 20% from local sales. •

Alptekin Erman



General Coordinator
BATURALP TAYLAN LTD.

- **Baturalp Taylan plays a crucial role in the Turkish market, as the sole provider of engine testing and automation services. Please introduce us to the company.**

Kadircan Baturalp established Baturalp-Taylan Ltd. Şti. in 1978, and remains co-owner of the company. At the time of its founding, the company was only engaged in the mechanical production of dynamometers, while electronic parts were outsourced to Turkish companies. I initially established my own company to produce full engine test systems including dynamometers, control units, software, conditioning units, and other equipment and instruments. Soon after establishing my company I took the opportunity to form a strong partnership with Mr. Baturalp in order to avoid competition and collaborate. Our partnership resulted in the production of all parts involved in engine testing and automation systems including dynamometer production and control units, engine control units, actuators, consumption measurement equipment for air,

water, oil, emission, blow by, fuel, gear shift control units, as well as conditioning units for air, fuel and water. Today Baturalp Taylan is proudly the only Turkish producer of dynamometers and engine test systems.

How significant is the aerospace and defense sector for Baturalp Taylan's business?

Defense customers are strategically important for Baturalp Taylan. Our strengths include working with land systems and hence our main client is the Turkish military. We work with reputable references and have already manufactured an engine test cell in Turkey for which we currently are the single source local supplier of the Turkish Armed Forces. We are able to supply them with more test cells upon request, given that all systems are ready. Our potential additional customers include those that use diesel, gasoline and electrically powered engines such as universities, overhaul factories as Komatsu or main automotive producers as Turk Traktor, Ford and others that already utilize our services for engine and vehicle test cells and sub systems. We are currently performing handover and acceptance tests of the T700-, T53-, and T63-type turbine engines test cells for the Turkish military. We designed and produced all mechanical and test cell automation computer systems in-house, locally in Turkey.

What is your vision for Baturalp Taylan?

We would like to expand the company's product offering, and become more competitive internationally. As the aerospace sector continues to expand, turbine engine use will increase, providing Baturalp Taylan with many prospects for success. •

Bariş Telseren



Vice President Eastern Europe (South)
BODYCOTE ISTAŞ

- **Bodycote operates in 24 countries with almost 200 hundred plants. Please provide a brief introduction to Bodycote's presence in the Turkish market.**

In 2006 Bodycote entered a joint venture with ISTAŞ, the largest heat treatment company in Turkey. Over the course of the past seven years Bodycote ISTAŞ has invested in new technologies and people to deliver top-notch services to its customers. To put our business in context, heat treatment is applied to metals, especially those involved in engine parts, to improve the mechanical properties of the component. Bodycote in Turkey applies this process to steel components in particular. Over the years we have grown our specialty businesses by utilizing the latest equipment, and today serve key clients in the automotive, machine, and aerospace and defense sectors.

What about the Turkish market compelled the company to establish operations here?

Not many countries are home to two engine plants (GE and Kale Pratt & Whitney), a national jet project, and a leading airline. In fact, Turkish Airlines has bolstered the aerospace sector, particularly in engine investments and equipment overhaul, given their phenomenal growth over the last ten years. As an emerging economy, Bodycote does not view Turkey as a short-term investment.

The Turkish aerospace and defense market is projected to grow by 4% to 5% over the next five years. How is Bodycote ISTAŞ planning to target this market?

Currently aerospace and defense comprises roughly 7% of Bodycote's total business volume in Turkey. We recently completed construction of a plant in Gebze, where we can support this sector. Overall, demand within this sector is growing and Bodycote ISTAŞ continues to receive new enquiries not only from original equipment manufacturers (OEMs) like Roketsan, Aselsan, and Turkish Aerospace Industries (TAI), but also from their suppliers, which are crucial for our business. Key clients are both OEMs and their suppliers that require heat treatment service for their parts. Orders from these clients are already on the rise, encouraging us to grow our operations significantly. Bodycote ISTAŞ has been preparing itself for growth by obtaining certifications such as the AS9100 as well as approvals from TAI, Korean Aerospace Industries (KAI), Roketsan, Aselsan and Sikorsky. Moreover, the civil aviation market is growing, leading to additional inquiries from companies working on major projects for Airbus and Boeing. •





INTO THE FUTURE: FINAL THOUGHTS



“A relatively young sector, the defense industry is critical for Turkey as well as the world. No matter how young, it is one of the fastest growing sectors. In the past nearly 50 years, our sector achieved great success, especially in the last 10 years, when it became one of Turkey’s strongest. We are increasing this force through our export volume, which are growing every year.”

- Latif Aral Aliş,
Chairman,
Defense and Aerospace Industry Exporters’
Association of Turkey (SSI)
and Turkish Defense Alliance (TDA)



“Turkey is a good market, and has started to excel in the [aerospace and defense] industry. The country’s potential is continually growing, but still not enough as the sector is not compact. While local companies can manufacture select spare parts, affixing them to the aircraft require additional parts that have to be imported. To achieve further consolidation, effective guidance from both the government and businesses is required, and is only possible through offsets.”

- Safak Herdem, Managing Partner,
Herdem Attorneys At Law



“Companies are coming to Istanbul either by establishing branch offices or relocating from Ankara to be closer to international names, airports, and strategic destinations.”

- Sercan Altinbas, International Relations Coordinator,
Teknopark Istanbul



“Otonom Teknoloji’s focus is on unmanned systems, and the company would like to entrench our position in this domain in domestic and neighboring markets. Although the company is developing aerial systems, the company is looking to extend its experience in unmanned systems, especially using MiniSteer for other unmanned platforms such as land or sea.”

- A. Nezir Erturk, General Manager,
Otonom Teknoloji



“If we consider that the 2014 export figure for Turkish defense industry is \$1,855 million and the growth from 2013 is around 18%, the growth in exports should be sustained for the next 10 years to attain the given target of \$5 billion for 2023. It will not be an easy task. If Turkey manages to timely field its weapon platforms in development, and invest as planned for the sub-system/equipment development, the country could become one of the privileged countries that have no or very few restrictions for exporting for their weapon systems by the 2020s.”

- M. Emre Yazıcı, Editor, Strategy & Development,
Military Science and Intelligence Turkish Defense Review (MSI)



“Endeavors related to design projects that enable the growth of technological competence, as well as studies regarding the improvement of R&D activities, will become more important in strengthening the sector. Obtaining a number of critical technologies as a result of these design and R&D activities will increase the number of indigenous products and hence the capability of the industry’s competitiveness in the world market. Within the context of the aforementioned strategic plan, the turnover target for the defense industry will be \$8 billion for 2016 with an export target of \$2 billion.”

- Arda Ermut, ISPAT & WAIPA President,
Investment Support and Promotion Agency of Turkey (ISPAT)



“Esen System Integration’s plans involve developing cost effective ISR solutions both for wide area camera systems and light ISR platforms. The company is also looking for opportunities to build low cost satellites for the same purpose. The core strengths of Esen System Integration are in remote sensing, space systems, airborne systems, and aircraft integration. Currently the company has 60 people in ODTÜ Teknokent and its other office in Bilkent Cyberpark.”

- Cem Uğur, General Manager,
Esen System Integration



“Alfa-Beta is a small company, but is growing larger each year. We are investing in CNC machines and trying to increase our manufacturing capacity, which is necessary to gain new customers. At present, 70% of our capacity goes towards the aerospace and defense industry.”

- Umut Isleyici, General Manager and Founder,
Alfa-Beta Makine



“Invest in Izmir has a regional development plan for 2014 to 2023 that is aligned with the national development plan. In the sectorial phase, the agency is facilitating entrepreneurship, eco-efficiency, research and development, and innovation. The next three years until 2017 investment promotion efforts are focused on renewable energy and ICT but is also on supporting the aerospace and defense sector financially.”

- Murat Yılmazçoban, General Secretary; Sedef Özer, Investment Support Coordinator;
- Halit Duran, Investment Support Office; and
- Hakkı Gökhan Elüstün, Investment Support Office;
Invest in Izmir



“Established as a university spinoff company in ODTÜ Teknokent, Aerotim Engineering has been selected as a single source vendor for developing Flight Dynamics Models for an FFS Level-D Turkish Army helicopter simulator program. The company is the only one building simulation software for helicopters and other unconventional flying objects—providing flight dynamics models, control systems and engine models for simulators—in the Turkish market. The time is ripe for Turkey to develop its own technologies, rather than reworking those already on the market.”

- Dr. Ilkay Yavrucuk, Founding Partner,
Aerotim Engineering Ltd.



“The average foot soldier carries 30 kilograms (kg) of supplies and five kg of batteries. This is a significant increase from the 1990s when the total weight of batteries in a soldier’s pack was half a kg. As new technologies are deployed, soldiers require increased sources of power to use them. To protect their survivability, mobility, operation sustainability and lethality, batteries need to be lighter, smaller, and easy to use. The challenges presented by greater dependence on mobile battlefield technologies mean that companies like ASPILSAN need to innovate in order to reduce the logistical and physical burdens for the Armed Forces.”

- Ferhat Özsoy, General Manager,
Military Battery Industry and Trade Inc. (ASPILSAN)



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This list contains those companies interviewed during the course of research for this publication and as such represents only a limited selection of the companies operating in the aerospace and defense industry of Turkey. It should not be considered a comprehensive guide. For further information on database access packages, please contact info@gbreports.com or call +44 20 7812 4511.

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ssm.gov.tr

**INVESTMENT SUPPORT AND PROMOTION AGENCY OF
TURKEY (ISPAT)**
invest.gov.tr

TURKISH ARMED FORCES FOUNDATION (TAFF)
tskgv.org.tr

**DEFENSE AND AEROSPACE INDUSTRY MANUFACTURERS
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