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Turkey's Defense Industry and Tusaş: Development From The Past to The Present and Future Perspectives

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This article examines the historical development of Turkey's defense industry and the role of key institutions such as Turkish Aerospace Industries Inc. (TUSAŞ). The process, extending from the Ottoman Empire to the present day, saw local production and industrialization initiatives evolve into a national industrial movement during the early years of the Republic. Critical milestones in this development include the establishment of the Military Factories General Directorate in 1921 and the founding of Machine and Chemical Industry Corporation (MKE) in the 1940s. After the 1974 Cyprus Peace Operation and the subsequent military sanctions imposed by the United States, the need for a domestic defense industry was reemphasized, laying the groundwork for the establishment of institutions such as ASELSAN and TUSAŞ. Since 2006, Turkey has become a global actor by enhancing its independence and domestic production capacity in the defense industry. Advanced technologies such as unmanned aerial systems and robotic devices have reinforced Turkey's geopolitical advantages. TUSAŞ has contributed to the nation's security and technological independence by increasing national and local production, supported by projects and strategic facilities such as the KAAN aircraft. This article evaluates TUSAŞ's projects and their impact on the defense industry, providing perspectives for the future.

Keywords: *Defense İndustry, TUSAŞ, Turkey, Domestic Production*

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1. Introduction

The roots of the Turkish defense industry trace back to the rise of the Ottoman Empire. During the reign of Fatih Sultan Mehmet, the Tophane-i Amire was established and produced some of the most advanced artillery of the time. Innovations such as rifled cannons and mortars were produced exclusively by the Ottoman Empire during this period. Weapon production facilities were established in various Anatolian regions, including Edirne, Istanbul, Erzurum, and Birecik, and research and development efforts in the defense sector were actively pursued. Additionally, ammunition production facilities were located in Istanbul, Thessaloniki, Belgrade, and Cairo. The technological advancements in the construction of warships during the empire's peak were far superior to those of other states. The 86 shipyards, excluding those in the private sector, exemplify the Ottoman Empire's advanced shipbuilding capabilities [1]. However, the decline of the Ottoman Empire also led to a weakening of the defense industry. Unable to keep pace with technological advancements in the West, the empire established some defense factories with England and France, but these efforts lacked continuity. The advent of steamships caused the Ottoman Navy to lose its strength. Economic hardships led to a halt in weapon production, which was reduced to maintenance and repair only [2]. Nevertheless, during World War I, the covert importation of some machines and hand tools to Anatolia facilitated the production of defense equipment during the Turkish War of Independence. During this period, light weapon and ammunition production workshops were established in Ankara, Konya, Eskişehir, Keskin, and Erzurum [3]. For an extended period, Turkey sought to meet its defense needs primarily through military aid, grants, and credits from Western countries, rather than developing its own national defense industry. The political administration played a significant role in adopting this policy. Consequently, the defense industry strategy was not fully developed initially, and the policies regarding the defense industry varied over different periods due to internal and external political preferences, leading to a lack of continuity and the failure to establish a national defense industry [1]. Today, the Turkish defense industry comprises both public and private sector organizations. The public sector includes supply and maintenance centers, shipyards, other military facilities, and the Machinery and Chemical Industry Corporation (MKE) under the Ministry of National Defense. The private sector consists of companies established with national capital and those with foreign partnerships. The Defense Industry Agency and the Turkish Armed Forces Foundation (TSKGV) are also among the public sector stakeholders [4]. Despite economic difficulties in the early Republican period, the defense industry was considered a key element of the state's development and industrialization. During the period from 1923 to 1938, under Atatürk's leadership, the defense industry was central to state policies, and a nationalistic approach was adopted. Investments in the defense industry during this era, led by the state and supported by private enterprises, laid the foundations of the Turkish defense industry [5]. The period from 1938 to 1950 was marked by stagnation in the development of the defense industry. The impact of World War II and changing political administrations led to a decline in the defense sector. Although Turkey did not participate in World War II, it felt the adverse effects of the conflict [4]. During this period, most defense equipment was imported. The Truman and Marshall Aid programs of 1947 impeded the development of the defense industry. These aids aimed to strengthen the military and economic capacities of countries bordering the Soviet Union. Under the Truman Doctrine, Turkey received $152.5 million in military aid between 1947 and 1949, and this amount reached $400 million between 1947 and 1951. The Marshall Plan provided $352 million to Turkey between 1948 and 1952. Initially, these aids contributed to the modernization of the Turkish defense industry, but over time, they had adverse effects as they served U.S. interests [6]. The activities in the defense industry between 1923 and 1950 are detailed in Table 1.

Tablo 1. Activities Related to the Defense Industry from 1923 to 1950

Organization / Activity	**Establishment Year**
General Directorate of Military Factories	1921
Ankara Arms Factory	1920-1921
Ankara Light Weapons and Artillery Repair Workshop	1924
Ankara Ammunition Factory	1924
Şakir Zümre Bomb Factory	1925
Eskişehir Aircraft Factory	1926
New Ammunition Factory	1927
Kırıkkale Rice and Electric Machinery Factory	1928
Kırıkkale Artillery Ammunition Factory	1929
Elmadağ Powder Factory	1929
Kayaş Capsule Factory	1930
Tayyare ve Motor Türk Anonymous Company (TOMTAŞ)	1933
Nuri Killigil Arms Factory	1933
Vecihi Faham Aircraft Construction Factory	1933
Kırıkkale Electric Power Plant and Steel Factory	1931
Nuri Demirağ Aircraft Factory	1936
Powder, Rifle, and Artillery Factories	1936
Gölcük and Taşkızak Shipyards	1941
Turkish Aeronautical Association Etimesgut Aircraft Factory	1940
Turkish Aeronautical Association Gazi Aircraft Engine Factory	1945
Machine and Chemical Industry Corporation (MKEK)	1950

Source: The author created the table herself.

Between 1950 and 1974, the Turkish defense industry entered a period of stagnation. Following Turkey's accession to NATO in 1952, the defense industry received support through grants, and the government withdrew its support for private enterprises. This led to a decline in domestic defense industry capabilities and an increase in dependency on foreign sources [4]. NATO assistance negatively impacted the acquisition of weapon technologies and brought production to a standstill. Western countries, while advancing their own defense industries, sought to hinder Turkey's development [7]. In 1950, the Military Factories General Directorate was transferred to the Mechanical and Chemical Industry Corporation (MKEK). MKEK acquired the facilities of the Turkish Aeronautical Association and produced the MKEK-4 Uğur aircraft, but production was halted due to the transition to jet engines and high costs [1]. While the development of domestic industry remained limited, it was transferred to textile factories and the Turkish Tractor Factory [8]. In 1965, the Turkish Naval Society was established, followed by the Turkish Air Force Strengthening Foundation in 1970. In 1974, the Turkish Ground Forces Strengthening Foundation was opened, and in 1981, the Turkish Naval Forces Strengthening Foundation was established [4]. In 1973, TUSAŞ was founded, followed by ASELSAN (1975), İŞBİR (1978), ASPİLSAN (1981), and HAVELSAN (1982), with increased investments in the defense industry [9]. Military coups are among the greatest obstacles to the stability and development of democratically governed states. Coups against democratically elected governments undermine the will of the people and lead to human rights violations. Coups are more commonly seen in developing or underdeveloped third-world countries and tend to weaken these nations economically and politically. The first military coup in Turkey occurred on May 27, 1960, against the Democrat Party. The Democrat Party, which had adopted liberal policies between 1950 and 1960, made significant economic strides, particularly investing in mechanization in agriculture and transportation through Truman and Marshall aid [10]. However, from 1955 onward, economic problems and severe criticisms of the administration increased, leading to a request for assistance from the IMF and the World Bank in 1958 [11]. On May 27, 1960, the Turkish Armed Forces intervened in governance through a coup, dissolving the National Assembly and the constitution. Many democratically elected politicians were arrested, and Cemal Gürsel became President [10]. The National Unity Committee (MBK) took over governance until the 1961 elections, but economic and political instability continued. During the MBK period, the State Planning Organization (DPT) was established, but this measure was insufficient to resolve economic issues [12]. In 1965, the MBK administration was transferred to civilian control through elections. Investments in the defense industry between 1950 and 1974 showed significant changes (Table 2).

Table 2. Activities Related to the Defense Industry from 1950 to 1974

Organization	Year Established
Anadolu Shipyard (ADİK)	1950
Kalekalıp Machinery and Die Industry Inc.	1969
İbrahim Örs Foundry and Industrial Trade Inc.	1952
Pendik Shipyard (Istanbul Shipyard Command)	1969
Denizcilik Bankası Camialtı Shipyard	1952
Turkish Air Force Strengthening Foundation	1970
Otokar Automotive and Defense Industry Inc.	1963
Elsis Inc.	1971
BMC Industry and Trade Inc.	1964
TÜBİTAK Defense Industry Research and Development Institute (SAGE)	1972
Turkish Navy Society	1965
Turkish Aircraft Industries Inc. (TUSAŞ)	1973
MAN Turkey Inc.	1966
HST Automotive Manufacturing Industry and Trade Inc.	1974
Mercedes-Benz Turkey Inc. (Otomarsan)	1967
Turkish Land Forces Strengthening Foundation	1974
Northern Electronic Telecommunications Inc. (NETAŞ)	1967
İŞBİR	1978

Source: The author created the table herself.

Between 1974 and 1985, numerous crises occurred between Turkey and the United States, including President Lyndon B. Johnson's letter to Prime Minister İsmet İnönü, the Opium Crisis, and the Cyprus Peace Operation. Notably, the Cyprus Peace Operation in 1974 marked a turning point for the Turkish defense industry. The U.S. arms embargo imposed on Turkey following the operation prompted Turkey to begin developing its defense industry, making it one of the primary reasons for this transformation. Additionally, it is known that this embargo was not solely related to the Cyprus Peace Operation but was also influenced by the Opium Crisis. The initiatives in the defense industry during the period from 1974 to 1985 are summarized in Table 3.

Table 3. Activities in the Defense Industry from 1974 to 1985

Organization/Company	Establishment Year
Askeri Elektronik Sanayi (ASELSAN)	1975
PETLAS Tire Industry and Trade Inc.	1976
Nurol Machinery Industry Inc.	1976
Hava Elektronik Sanayi (HAVELSAN)	1982
Askeri Pil Sanayi ve Ticaret A.Ş. (ASPİLSAN)	1981
Gürdesan Ship Machinery Maritime Industry and Trade Inc.	1983
General Directorate of Defense Industries	1983
Turkish Aerospace Industries Inc. (TUSAŞ-TAI)	1984
Aksa Generator Industry Inc.	1984
BAYKAR	1986

Source: The author created the table herself.

Table 6 provides a detailed overview of the defense industry initiatives conducted between 1985 and 2006.

Table 4. Activities Related to the Defense Industry from 1985 to 2006

Company Name	Year of Establishment
TUSAŞ Engine Industry (TEI)	1985
ROKETSAN	1988
Defense Technologies Engineering and Trade Inc. (STM)	1991
Karel Electric and Electronic Inc.	1986
RMK Marine Shipbuilding Industry	1997
STFA Savronik Electronics Industry and Trade Inc.	1986
HAVELSAN Technology Radar Industry and Trade Inc. (HTR)	1990
Vestel Defense Global Technical Inc.	2003
Microwave Electronic Systems Industry (MIKES)	1987
MTU Turkey Engine Turbine Industry and Trade Inc.	1990
SDT Space and Defense Technologies	2005
FMC-Nurol Defense Industry Inc. (FNSS)	1987
Defense Industry Association (SaSaD)	1990
Meteksan Defense	2006

Source: The author created the table herself.

In the 2000s, defense industry exports increased, and during the 2010s, there was a focus on meeting critical technology needs through domestic sources and emphasizing original design programs. During this period, projects such as the MİLGEM Corvette, ALTAY Tank, ATAK Attack Helicopter, ANKA, and BAYRAKTAR Unmanned Aerial Vehicles contributed to reducing dependence on foreign defense technology [2]. In 2018, the Undersecretariat for Defence Industries was restructured as the Presidency of Defence Industries. In 2020, FNSS exported wheeled armored vehicles to Oman, and the first deliveries of the AKINCI TİHA and AKSUNGUR SİHA were completed. Planned projects for 2024 and beyond include significant developments such as the maiden flight of the BAYRAKTAR KIZILELMA combat unmanned aircraft, the export of the ATAK Helicopter and AKINCI TİHA, the delivery of the KAPLAN MT tank to Indonesia, and the first launch of the TAYFUN missile. Turkey aims to strengthen its position in the international arena by increasing its domestic and national production capacity in the defense industry [13].

2. TUSAŞ-Turkish aerospace ındustries ınc. (taı: turkish air ındustries)

Turkish Aerospace Industries Inc. (TUSAŞ) was established on June 28, 1973, under the Law No. 1784 of the Turkish Aircraft Industry Joint Stock Company and is based in Ankara, operating under the Ministry of Industry and Technology. The law stipulated that TUSAŞ's objectives include advancing the country's technological level, contributing to national income, reducing dependence on foreign economies, and establishing an aviation industry capable of competing in international markets. TUSAŞ is committed to achieving these goals based on principles of efficiency and profitability while keeping pace with technological innovations. The company's activities encompass the production and assembly of all aircraft, helicopters, and both motorized and non-motorized vehicles used in military and civil aviation. Additionally, TUSAŞ manufactures and trades spare parts, equipment, and materials for these vehicles. It engages in the buying and selling of real estate and the mortgaging of movable and immovable properties to secure loans. The company also establishes manufacturing and sales enterprises, builds hangars, warehouses, and repair shops, and may lease these facilities or provide them to public institutions if necessary. Moreover, TUSAŞ forms or joins relevant partnerships and conducts commercial transactions related to all of the aforementioned activities. The majority of the 1.5 billion TL investment required for TUSAŞ's establishment was provided by the Turkish Air Force Strengthening Foundation [14]. The establishment of TUSAŞ was anticipated within the scope of the 3rd Five-Year Development Plan, which outlined the creation of an aircraft industry under state supervision to enhance the country's technological level and meet the military and civil aircraft needs. Various organizations and industrial entities were to collaborate for the support and continuity of the enterprise, and the designated programs and measures were to be implemented. However, TUSAŞ could not become fully operational for an extended period after its establishment. During the 3rd Five-Year Development Plan period [1973-1977), various studies were conducted, such as the "aircraft manufacturing master plan," "aircraft factory site selection," and "aircraft type and manufacturing program," but as the IVth Plan period began, issues in foreign economic and political relations negatively impacted aircraft type selection, technology transfer, and external financing, hindering the development of the industry [15]. A factory was planned to be established in Kayseri by the Air Force, with the production of the TC-111 model light transport aircraft. However, the project was not realized due to short-term governments and coalition periods, economic difficulties, and the lack of representation from the Ministry of National Defense (MSB) since TUSAŞ was established under the Ministry of Industry and Technology. Another project under consideration during this period was the "Jet Evolutionary Training and Attack Aircraft Project." In line with the needs of the Air Force Command, on June 5, 1976, TUSAŞ requested bids from various manufacturers for the production of 60 aircraft. On December 1, 1976, four firms from the UK, Germany, the USA, and Italy submitted proposals. On October 6, 1977, the TUSAŞ Board of Directors unanimously accepted the offer from the Italian Aermacchi company and decided to enter into an agreement for the joint production of 60 MB339 aircraft. However, on October 21, the MSB sent a written notice to then-Prime Minister Süleyman Demirel stating that the decision was incomplete and inadequate. Demirel requested the Minister of Industry and Technology, Oğuzhan Asiltürk, to act in accordance with these demands. Asiltürk provided a response to Demirel's letter but did not attend the signing ceremony on October 26, which was postponed to October 29. On October 27, the General Staff informed Prime Minister Demirel that the British-suggested "Hawk" jet was preferred and that the MB339 was economically and technically unsuitable. Consequently, the signing ceremony on October 29 was canceled. Interestingly, the Hawk aircraft chosen during this process were not purchased later; between 1977 and 1983, Turkey acquired 32 T-33A and T-33 Mk. III aircraft from France and Germany, 20 T-37B aircraft from the USA in 1978, and 30 T-38A aircraft from the USA between 1979 and 1980 [16]. On November 25, 1978, TUSAŞ's General Manager and Chairman of the Board, Saim Dilek, decided that TUSAŞ would produce fighter aircraft. Following this decision, a briefing was provided to the Chief of General Staff, General Kenan Evren, and Deputy Chief of Staff, General Haydar Saltık, on December 18, 1978. On February 9, 1979, the Chief of General Staff instructed TUSAŞ to produce fighter aircraft. This instruction stipulated that production should commence in 1982 and that 291 aircraft (51 of which were options) should be delivered to the Air Force Command within ten years. As a result of collaborative efforts between the Air Force Command and TUSAŞ, on April 4, 1979, eight aircraft companies were invited to show interest in the production of nine different aircraft types in Turkey, and initial technical information was requested. The aircraft types included Mirage F-1E, Mirage 2000, Jaguar, Northrop F-5E, Viggen, Tornado, F-14, F-16, and F-18. It was decided to obtain licensed or joint production offers from the companies providing positive responses. Simultaneously, on April 12, 1979, the High Planning Council decided to establish the aircraft factory in Ankara. Following discussions in 1979-1980, offers were received for Mirage F-1E, Jaguar, and Northrop F-5E aircraft. Permission for the newer-generation F-16 and F-18 aircraft from the US government was granted on June 15, 1981. Since then, discussions with the US intensified, and project decisions were made. Initially, the production of 291 aircraft was divided into two batches of 160 and 131. It was decided that one billion dollars of the project's cost would be covered by domestic sources, with the remainder financed through Foreign Military Sales (FMS). The selection of the aircraft type to be produced and the signing of the joint production agreement were planned for 1983 [17]. The short list for the tender included the F-16 Fighting Falcon, F/A-18 Hornet, and F-20 Tigershark. On February 16, 1983, a delegation consisting of Brigadier General Sadi Kaban, Colonel Üzeyir Batur, and Major Okan Öncel traveled to the USA to test the aircraft and prepare detailed technical reports. Although the F/A-18 aircraft was technologically superior to the F-16s and was developed for use on aircraft carriers, it was not preferred due to its high unit cost and maintenance expenses. The performance of the F-20 was deemed insufficient. For these reasons, the decision was made to purchase the F-16 aircraft. Turkey requested that the F-16s be produced domestically, and on December 9, 1983, an agreement was signed with the USA for the joint production of 160 F-16 aircraft. Under the agreement, a partnership was established between TUSAŞ and the aircraft manufacturer General Dynamics. The company's capital was 137 million USD, with 67 million USD provided by foreign partners. Of this amount, 24 million USD was allocated to cash, 22 million USD to factory equipment and facilities, and 21 million USD to technical services. The shares of the company were distributed as follows: 49% to TUSAŞ, 1.9% to the Turkish Armed Forces Strengthening Foundation, 0.1% to the Turkish Aeronautical Association, and the remaining 49% to the foreign partners, with 42% belonging to General Dynamics. The new factory was to be constructed in Mürted, Ankara [18]. As a result of these decisions, TAI, established through the Turkish-American partnership, commenced operations on May 15, 1984, under the Turkish Commercial Code and the Foreign Capital Encouragement Law. Its official opening was held on October 30, 1984, by President Kenan Evren. The company was initially established with foreign partnership for 25 years; however, the foreign shares were purchased and restructured in 2005. During this restructuring, TAI and TUSAŞ merged to continue operations under the name TUSAŞ-Turkish Aerospace Industries Inc. Following the merger, 54.49% of the shares belong to the Turkish Armed Forces Strengthening Foundation, 45.45% to the Presidency of Defense Industries, and 0.6% to the Turkish Aeronautical Association [19-22].

3.TUSAŞ production and project development process [1987-2023)

Since its transition to production in 1987, TUSAŞ has been involved in numerous production programs and projects, establishing itself as a cornerstone of the Turkish Air Force Industry. The aircraft production process in Turkey, which began in 1925 and ceased after World War II, was revitalized with the establishment of TUSAŞ.

3.1. Project peace onyx ı

In line with its requirements, the Turkish Air Force (HvKK) decided to replace its F-104 aircraft, which had reached the end of their operational life and had become obsolete as a weapon system. Consequently, TUSAŞ entered into an agreement with General Dynamics/Lockheed for the production of 160 F-16 C/D aircraft [23]. According to the Letter of Offer and Acceptance (LOA) signed with the U.S. Government on December 9, 1983, the agreement's value was set at $4,158.2 million. Of this amount, $3,436.4 million was allocated for the aircraft's cost, while the remaining amount covered the necessary equipment and other expenses for the Turkish Air Force. The LOA stipulated that $2.750 million of this amount would be financed through Foreign Military Sales (FMS) credits. According to the agreement, the assembly of 152 out of the 160 aircraft would be carried out at TUSAŞ facilities. Additionally, TUSAŞ was responsible for producing 112 rear fuselages, 100 mid-fuselages, and 88 wings at its Mürted facilities. The company also produced approximately 7,800 necessary parts, assemblies, and jigs [24]. The selection team for the aircraft type, which included Pilot Major Okan Öncel, faced a tragic loss as he was martyred in an accident due to winter conditions on November 17, 1983 [25]. Consequently, the project was named in honor of the fallen pilot. The first eight aircraft produced under the project were manufactured in Fort Worth, USA, and delivered directly to the Turkish Air Force [26]. By 1987, TAI's assembly lines were operational, and gradually, component and part production lines were established. The flight tests for the first F-16 aircraft emerging from TAI's assembly line were conducted on October 11, 1987 [27]. The initial 44 aircraft were produced in the F-16 C/D Block-30 configuration, and from the 45th aircraft onward, Block-40 production commenced [28]. Between 1987 and 1995, TUSAŞ successfully produced and delivered a total of 152 F-16 C/D aircraft in Block-30 and Block-40 configurations as planned, contributing to 70% of the aircraft’s body production [29].

3.2. Project peace onyx ıı

During the Gulf War, the "Turkish Defense Fund" was established in recognition of Turkey's contributions. Kuwait and Saudi Arabia each pledged $1 billion to this fund, while the United Arab Emirates, the United States, and Turkey each committed $500 million [30]. The Öncel II Program, which would be largely financed by this fund, was finalized with the signing of the LOA in March 1992. This program aimed at the joint production of 40+40 (40 firm and 40 optional) F-16 C/D Block-50 or Block-52 aircraft. TAI took on the responsibility for producing the forward fuselage starting from the 41st aircraft in the Öncel II Project. Along with this significant workload, the project also included the production of vertical tail stabilizers, rudders, and ailerons [31]. Following the completion of the Öncel I Project in 1995, the Öncel II Project commenced. Between 1995 and 1999, 80 F-16 Block-50 aircraft were produced and delivered. In this project, TUSAŞ's share in fuselage manufacturing reached 80% [32].

3.3. Peace vector ıv program

The Peace Vector IV Program encompassed the production of 46 F-16C aircraft for the Egyptian Air Force. Initially, the Arab Republic of Egypt preferred to acquire these aircraft directly from General Dynamics facilities in the USA due to urgent delivery requirements. However, Turkey made significant efforts to persuade Egypt by emphasizing that there would be no issues with the delivery process. Initially, a delegation from the F-16 Systems Department of the Ministry of National Defense visited Egypt, but this visit did not yield positive results. Subsequently, Minister of National Defense Safa Giray invited the Commander of the Egyptian Air Force to Turkey. In February 1991, a delegation led by Major General Sayed Kamel Abdel Wahab, Chief of Staff of the Egyptian Air Force, visited TAI for on-site evaluations [33]. It was demonstrated that TAI’s quality standards were equivalent to those of the U.S. facilities and that there would be no delivery issues. In May, a delegation led by General D. Çelikay, Undersecretary of the Ministry of National Defense, visited Egypt, finalized the agreement, and signed the contract. The first aircraft was planned to be delivered to Egypt in November 1993, and the project was successfully completed between 1993 and 1995, with a total of

46 F-16 aircraft delivered to the Egyptian Air Force[(34]. In these three projects, a total of 278 aircraft produced at TAI facilities were assessed as “excellent” for three and “zero defect” for 29 [35].

3.4. SF-260D basic trainer aircraft production program

The project aimed to meet the initial flight training needs of the Air Force and other pilot training institutions through local production. From April 28, 1989, offers from various companies were evaluated [36]. Following these evaluations, an agreement was reached with the Italian company Agusta for the joint production of the SF-260D Marchetti trainer aircraft. In Phase A of the project, a total of six aircraft were delivered to the Air Force Command in 1991 [37]. In Phase B, the first aircraft assembled by TAI began flight tests on July 15, 1991 [38]. Between 1991 and 1993, a total of 34 aircraft were assembled and delivered by TAI [39].

3.4. CASA (CN-235) production program

The Undersecretariat for Defense Industries (SSM) initiated a project to meet the Turkish Air Force's need for a light transport aircraft. Proposals were solicited from Aeritalia (Italy), CASA (Spain), De Havilland (Canada), and SAC North America (USA). However, De Havilland chose not to sell directly, and SAC North America withdrew its offer to participate in the tests. Consequently, only the aircraft from Aeritalia and CASA were included in the tests, which began on April 24, 1989. CASA's CN-235M aircraft was selected as a result of these tests [40]. The project decided to procure a total of 52 light transport aircraft, including 2 ready-made units. Turkish Aerospace Industries Inc. (TAI) was tasked with overseeing various stages of the aircraft production process, including final assembly, detailed assembly, part production, system integration, flight line operations, and flight testing. In subsequent phases of the project, fuselage production aimed to achieve a 90% production rate by project completion [41]. Since 20% of the CN-235M fuselage is made from composite materials, an agreement was made with CASA for the establishment of composite production facilities and technical training, enabling TAI to acquire composite material production technology [42]. Between 1991 and 1998, 50 CN-235 light transport aircraft were delivered to the Air Force Command. Subsequently, an additional contract effective from July 1999 led to the production and delivery of 3 Maritime Patrol Aircraft for the Coast Guard Command and 6 CN-235 maritime surveillance aircraft for the Naval Forces Command. The aircraft fuselage production rate was increased to 95% with this project [43].

3.5. Cougar AS-532 production program

The Cougar AS-532 helicopters were produced by the "EUROTAI Consortium," established between Turkey and France under the "Phenix-II Program." The project envisaged the production of 30 helicopters between 1997 and 2003. While the first two helicopters were manufactured at Eurocopter's facilities in France, the remaining 28 helicopters were produced at Turkish Aerospace Industries Inc.'s (TAI) Akıncı facilities[44]. According to the production plan, 20 of the 30 helicopters were intended for the Turkish Air Force (TAF), and 10 were for the Turkish Land Forces Command (TLFC). Production at TAI facilities commenced on September 30, 1998, and the first helicopter was delivered to the Land Forces on May 31, 2000[45]. The last helicopter was delivered to the Land Forces on June 27, 2003, completing the project. The Cougar helicopters represent a significant milestone as TAI's first rotary-wing aircraft production program[46]. All fuselage components, excluding the engine, rotor blades, and gearbox, were produced by TAI[47]. Other Turkish defense industry companies, including TEI, ASELSAN, Kalçakalıp, Netaş, Bestaş, KIBM, and ASPİLSAN, also contributed to the project. The local content of the produced Cougar helicopters was set at 30%[48]. Of the 10 Cougar helicopters delivered to the Land Forces, 6 were designed for general purpose and 4 for search and rescue (SAR) missions. Of the 20 helicopters delivered to the Air Force Command, 14 were for SAR missions and 6 were for Combat Search and Rescue (CSAR)[49].

3.6. UAV-X1 Şahit project

In 1989, TAI initiated the UAV (Unmanned Aerial Vehicle) X1 Şahit Project to keep pace with technological developments. The project planned to produce two UAV prototypes[50]. Production of these UAVs began in 1990 and was completed in 1992, but the project did not advance to serial production[51]. Following the prototype production, TAI aimed to continue with the UAV-X2 Şahit Project to enhance UAV performance; however, due to insufficient funding, the project was not completed[52].

3.7. Hava dolmuşu 19 (hd-19) project

Under the HD-19 Project, TAI carried out preliminary design studies for a 19-passenger, twin-turboprop-powered aircraft. The HD-19 was designed not only as a passenger aircraft but also in versions with extended fuselages for cargo and military uses. The conceptual design and pre-feasibility stages of HD-19 were initiated in 1993 by the TAI Design and Development Department using its own funds. Due to the high costs of development, TAI applied to the State Planning Organization in 1994, and the 1995 budget allocated 20 billion TL from the Ministry of Industry and Trade. This budget allowed TAI to start preliminary design work and produce a mock-up including a pilot and passenger cabin. An additional allocation from the 1996 budget was requested for full production [53]. However, due to inadequate funding, the project was terminated.

3.8. A400M Next-generation transport aircraft procurement program

In 2003, Turkey joined the A400M Next-Generation Transport Aircraft Procurement Program to replace its existing C-130 and C-160 transport aircraft with a more modern aircraft. This program is conducted under the framework of the European Defence Agency (EDA), although Turkey is not a member of the organization. Turkey joined as a partner along with Germany, France, the United Kingdom, Belgium, Spain, and Luxembourg. Representing Turkey, TUSAŞ participated actively in the design and production phases. Under the program, many components of the aircraft, including fuselage sections and speed brakes, were produced by TUSAŞ[54]. The program involves seven partner countries and has a total value of 20 billion Euros. Initially, the goal was to produce 180 aircraft, with serial production planned to start in 2009. Germany was to receive 60 aircraft, France 50, Spain 27, the UK 25, Turkey 10, Belgium 8, and Luxembourg 1 aircraft. All aircraft were expected to be delivered by 2021[55]. However, due to financing issues, the delivery schedule was delayed. Airbus, the main contractor, requested an additional 5.2 billion Euros in funding. Although partner countries pledged an additional 3.5 billion Euros, Airbus deemed this amount insufficient, resulting in a 4-year delay in the project[56]. Eventually, the issues were resolved, and Turkey received 9 A400M aircraft between 2014 and 2019, with the final aircraft delivered in 2022. Turkey paid 1.3 billion Euros for the project, while TUSAŞ earned 750 million Euros during this process. Total revenues for Turkish companies are expected to reach 1 billion Euros[57]. The high performance and reliability of the A400M aircraft make additional orders likely. In this context, TUSAŞ and other Turkish companies are expected to gain further revenue. Turkey is actively using the A400M aircraft, which are employed as military cargo aircraft and frequently used for overseas missions. For instance, during the COVID-19 pandemic, these aircraft were utilized for various missions abroad. Given Turkey's intense military activities and civil missions, expanding the transport aircraft fleet is necessary. Additionally, considering Turkey's role as a partner in the A400M project, placing additional orders could be considered.

3.9. Medium-altitude long-endurance turkish unmanned aerial vehicle (ANKA) and aksungur projects

The Republic of Turkey realized the importance of the defense industry with the Cyprus issue and, from the 1970s onwards, made investments in this field as a state strategy. Projects carried out since the 1970s have generally been production under license or joint production projects. As of 1996, UAV and helicopter projects were initiated to meet the needs of the Turkish Armed Forces (TSK), but no results were obtained from these projects for a long time. With Murad Bayar's appointment as Undersecretary of the Defense Industry, the first steps were taken to produce the ongoing projects with national capabilities. Decisions that can be considered turning points for the Turkish defense industry were made at the Defense Industry Executive Committee (SSIK) meeting on May 14, 2004. At this meeting, existing helicopter and UAV projects, which had been conducted since 1996 and cost $11 billion, were canceled, and it was decided that these projects would be carried out with domestic resources. The first project signed at this historic meeting was the Turkish Medium Altitude Long Endurance (MALE) UAV Project. While it was envisaged that many local companies would contribute to the project, it was decided that TUSAŞ/TAI would be the main contractor responsible for the design and production process[58]. Although the UAV project was signed in 2004, no significant progress was made until 2007. For Turkey, a country with very little experience in this field, these three years were spent on documentation work and determining the requirements. To prevent further delays and bring the project to life, the Presidency of Defense Industries (SSB) consolidated user requirements, and after negotiations, some requirements were accepted as they were, while others were revised. The necessary agreement to start the project was signed on October 9, 2007[59]. With this signature, the project truly began. As of July 2010, the first prototype rolled out of the hangar, and the UAV was named “ANKA.” By December 2010, the ANKA Block-A version began test flights[60]. The testing process continued until February 2013, and the acceptance tests were completed, marking the end of the first phase of the project. With the successful completion of the ANKA Block-A version, work on the second phase of the project, the ANKA Block-B version, was carried out simultaneously. ANKA Block-B made its first flight in January 2015. Meanwhile, development activities for the third version of the project, ANKA-S, which was developed according to the requirements of the Air Force, continued. ANKA-S was developed as a UAV with the critical capability of being controlled via satellite (SATCOM)[61]. After a long and arduous process, the efforts finally paid off, and the product was realized. First, ANKA Block-A started its missions within the Land Forces Command as of April 2016. ANKA Block-A was followed by Block-B, which began its missions within the Gendarmerie General Command in March 2017. In April 2017, ANKA Block-B gained armed mission capability with the integration of MAM-L guided bombs. The deliveries of ANKA-S to the Air Force Command were completed as of January 2018, successfully concluding the project with three versions[62]. With the experience gained from the ANKA Project, TUSAŞ began working in September 2017 on designing a larger, twin-engine UAV capable of carrying more weapons, based on the ANKA UAV. As of February 2018, the preliminary design work of the UAV to be developed was completed. A few months later, a Critical Design Review meeting was held, and TUSAŞ was given 17 months to produce the UAV, which would be used for reconnaissance, surveillance, and attack missions. Sharing many common infrastructure products with ANKA, the new UAV was prepared by TUSAŞ in a short period of 17 months and rolled out of the hangar. During this process, the High Payload Capacity UAV System was named AKSUNGUR. AKSUNGUR successfully passed ground tests in a short time and made its first test flight on March 20, 2019. In this test flight, AKSUNGUR managed to stay in the air for 4 hours and 20 minutes[63]. The ANKA and AKSUNGUR platforms are successful weapon platforms actively used by the Turkish Armed Forces. Deliveries of both platforms to the Turkish Armed Forces and the Ministry of Interior continue. With their proven performance in domestic and international operations, ANKA and AKSUNGUR platforms have also achieved success in receiving orders from abroad.

3.10.Turkish basic trainer aircraft (HÜRKUŞ)

The Turkish Air Force, having exhausted the operational lifespan of its American-made T-37 training aircraft, approached the Undersecretariat for Defense Industries (SSM) to address its training aircraft needs. In response, SSM conducted an extensive review of various training aircraft used worldwide between 2003 and 2004 and requested TUSAŞ to prepare for the production of a plane then known as "Vortex." Due to the urgent need for training aircraft, it was decided to procure the aircraft through off-the-shelf purchases. As a result of these evaluations, the Korean Aerospace Industries' KT-1 aircraft were selected for pilot training, and 40 units were purchased. At the last moment, SSM added a clause to this procurement decision, requiring TUSAŞ to develop a unique basic trainer aircraft to enhance Turkish industry's design capabilities. Consequently, on January 15, 2005, TUSAŞ and SSM agreed to the project, and the necessary agreements were finalized between TUSAŞ and SSM on March 15, 2006[64]. The design and testing activities for the HÜRKUŞ, the first Turkish aircraft to receive a "type certificate" from the European Aviation Safety Agency (EASA), continued until 2010. By November 2010, assembly work commenced, and the first aircraft, completed on June 27, 2012, was officially rolled out[65]. On December 26, 2013, a contract was signed for TUSAŞ to produce 15 HÜRKUŞ Basic Trainer Aircraft[66]. However, deliveries under this contract did not occur as planned. According to statements made, three aircraft were delivered to the Turkish Air Force, while the remaining 12 were expected to be delivered by 2019. In January 2022, TUSAŞ General Manager Professor Dr. Temel Kotil announced that the first batch of six aircraft would be delivered in February 2022. Kotil also mentioned, “The body material is aluminum. We are making HÜRKUŞ again. We are making a second HÜRKUŞ, which will be quite composite”[67]. Despite these statements, there are no confirmed reports of HÜRKUŞ aircraft being delivered to the Turkish Air Force. While it is publicly known that 15 HÜRKUŞ aircraft, which did not enter the Turkish Air Force inventory, were exported to various African countries, the development of HÜRKUŞ-2 is underway to meet the needs of the Turkish Air Force, with deliveries expected by 2025[68].

3.11. ATAK tactical reconnaissance/attack helicopter project

The ATAK Project, aimed at developing an Attack and Tactical Reconnaissance Helicopter for the Turkish Land Forces, was initiated following a decision made at the SSİK meeting on October 7, 1996. The project was announced in 2000, following Bell Textron's "AH-1Z King Cobra" helicopter's win. However, the project faced significant delays, and on May 14, 2004, the SSİK announced that the existing version of the project was canceled, and a new procurement model would be introduced. This led to a fundamental restructuring of the project. Initially, 145 helicopters were planned for procurement, but this number was revised to 50 firm and 41 optional. Additionally, the original project had a local content requirement of 50%, but disagreements over the flight and weapon system software led to a stipulation that the software must be developed locally. After completing the necessary preparations, SSM reopened the ATAK Helicopter Tender on February 10, 2005, with the publication of the Request for Proposal document. While American companies did not participate due to their refusal to provide source codes, Italian AgustaWestland, South African Denel, French Eurocopter, and Russian Kamov companies entered the tender. After negotiations, it was announced on March 30, 2007, that AgustaWestland had won the tender with its "A-129 Helicopter." By April 2007, negotiations began between TUSAŞ, SSM, ASELSAN, and AgustaWestland, and the necessary contracts were signed on September 7, 2007 [69]. Under this contract, TUSAŞ took on the role of the main contractor, responsible for platform development, system integration, testing and validation, serial production, and life-cycle logistics support. The ATAK Helicopter made its first flight on August 17, 2011. Following the testing and qualification process, the first deliveries to the Turkish Land Forces were made on April 22, 2014. Under the ATAK Program, the Turkish Land Forces ordered a total of 91 helicopters, including 59 firm orders, while the Ministry of Interior placed an order for 27 helicopters, including 24 firm orders [70]. Although the ATAK T129 Helicopter was primarily developed from the Italian A129, it has evolved into a much more advanced helicopter compared to its predecessor. Additionally, the T129, which has successfully served in both domestic and international operations, has achieved notable export success.

3.12. TUSAŞ projects and contributions to national security

TUSAŞ (Turkish Aerospace Industries) has significantly contributed to national security through its various projects and has become a cornerstone of the Turkish aerospace industry by gaining both financial and technological experience for larger projects. Particularly since the 2010s, TUSAŞ has been developing indigenous projects that will greatly aid the Turkish Air Force in overcoming its dependency issues. Notable projects under development at TUSAŞ include General Purpose Helicopters, Heavy-Class Attack Helicopters, Jet Trainers and Light Attack Aircraft, Unmanned Aerial Vehicles (UAVs), and 5th Generation Fighter Aircraft.

3.13. General purpose helicopters

TUSAŞ is developing two general-purpose helicopters: the T-625 GÖKBEY and the T-925. The T-625 GÖKBEY project was initiated based on a decision made at the SSİK meeting on June 15, 2010. The project formally commenced with the signing of agreements between SSM and TUSAŞ on June 26, 2013. The T-625 GÖKBEY, with a takeoff weight of 6 tons, made its first flight on September 6, 2018, and has since moved to the serial production phase [71]. It is designed for various roles including transport, VIP, ambulance, cargo, search and rescue, and offshore transport. Despite the announcement that T-625 GÖKBEY would be delivered to the Gendarmerie General Command in 2023, there has been no public information on any actual deliveries. The second project, the T-925 General Purpose Helicopter, is less documented in open sources. However, TUSAŞ General Manager Prof. Dr. Temel Kotil has revealed that the T-925 will have an 11-ton takeoff weight and a ramp for carrying military vehicles and artillery. Kotil also announced that the first flight of the T-925 is scheduled for March 18, 2024 [72].

3.14. Heavy-class attack helicopter

Another significant project is the Heavy-Class Attack Helicopter, known as T-929 ATAK-2. Development for the ATAK-2 began on February 17, 2019. Following the completion of design and structural production phases, ground tests were completed, and the first test flight was conducted on April 23, 2023. The ATAK-2 has a takeoff weight of 10 tons and a weapon carrying capacity of 1200 kilograms [73].

3.15. Jet trainer and light attack aircraft

TUSAŞ is also advancing in jet-powered aircraft with the HÜRJET Project. Initiated with SSB in July 2017, the HÜRJET Project aims to produce two variants: a standard trainer aircraft and an armed version equipped with fire control systems, radar, external payloads, and various mission systems [74]. The first prototype's engine was tested on January 30, 2023, and taxi tests began on March 18, 2023. The HÜRJET made its first flight on April 25, 2023, and initial orders include four plus twelve units, with deliveries expected to begin in 2025 [75].

3.16. Unmanned aerial vehicles

In the UAV sector, TUSAŞ has made significant strides with the ANKA and AKSUNGUR projects and is now advancing the ANKA-3. The ANKA-3, designed with a jet engine, aims to achieve high speeds (0.7 Mach) and a reduced radar cross-section due to its tailless design. It will be capable of carrying a 1200-kilogram payload and staying airborne for up to 10 hours. The ANKA-3 will perform a range of missions including reconnaissance, surveillance, intelligence, and various attack roles [76].

3.17. National combat aircraft (KAAN)

The most prominent project is undoubtedly the National Combat Aircraft (KAAN) Project. If successful, this project will mark a significant milestone towards achieving aviation independence, a goal envisioned since 1925. KAAN is a 5th Generation fighter aircraft designed to gradually replace the Turkish Air Force's F-16s starting in the 2030s. The KAAN Development Project Contract was signed on August 5, 2016, between SSB and TUSAŞ, with collaboration from the UK’s BAE Systems. The KAAN will feature advanced technologies such as low radar visibility, internal weapons bays, high maneuverability, enhanced situational awareness, and sensor fusion [77]. The first flight is planned for late 2023, with deliveries expected to begin in 2028.

4. Conclusion

The purpose of this paper is to comprehensively examine the historical development of Turkey's defense industry and its impact on the contemporary defense sector. The evolution of Turkey's defense industry has undergone significant changes and transformations from the Ottoman Empire era to the present day. Following the advanced technologies and large-scale production facilities of the Ottoman period, the infrastructure weakened during the early years of the Republic. However, after 1923, it was revitalized through state-supported investments. The embargo following the 1974 Cyprus Peace Operation highlighted the need for increasing domestic production capacity in Turkey's defense industry, leading to the establishment of organizations such as ASELSAN, ROKETSAN, and TUSAŞ. Investments and reforms made since the early 2000’s have positioned Turkey as a competitive player in the global defense market. Investments in unmanned aerial vehicles and advanced technologies have elevated Turkey's defense industry to international standards. Projects like TUSAŞ's KAAN aircraft have significantly enhanced Turkey's capabilities in the aerospace sector. In this context, it is anticipated that Turkey's defense industry strategies will continue to evolve in response to rapidly advancing technologies and global geopolitical dynamics. Investments in advanced technologies and the strengthening of national production capacity will enhance Turkey's international competitive edge. TUSAŞ's projects and investments will position Turkey's defense industry more robustly on the international stage and contribute to the country's global strategic objectives. In conclusion, this paper demonstrates how the development process of Turkey's defense industry not only serves to ensure national security but also contributes to the goal of becoming an influential player on the international stage. The steps taken in Turkey's defense industry will support the country's global strategic goals and enable it to achieve a stronger position in the international arena.

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