



UNPACKING THE DEBATE ON TURKISH DRONES

SİBEL DÜZ

SETA | REPORT

UNPACKING THE DEBATE ON TURKISH DRONES

SİBEL DÜZ

Sibel Düz completed her BA in International Relations at the Middle East Technical University (METU) in 2013. Her main research interests include military & strategic studies, countering violent extremism (CVE) and terrorism (CT).

COPYRIGHT © 2021 by SETA

SETA Publications 196
First Published in 2021 by SETA
ISBN: 978-625-7712-85-9

All rights reserved.

No part of this book may be reprinted or reproduced or utilized in any form or by any electronic, mechanical or other means, without permission in writing from the publishers.

The conclusions and recommendations of any SETA Foundation publication are solely those of its author(s), and do not reflect the views of the Institution, its management, or its other scholars.

Layout: Said Demirtaş
Printed in Turkey, Turkuvaz Haberleşme ve Yayıncılık A.Ş., İstanbul

SETA | FOUNDATION FOR POLITICAL, ECONOMIC AND SOCIAL RESEARCH

Nenehatun Cd. No: 66 GOP Çankaya 06700 Ankara TURKEY
Tel: +90 312.551 21 00 | Fax: +90 312.551 21 90
www.setav.org | info@setav.org | @setavakfi

SETA | İstanbul

Defterdar Mh. Savaklar Cd. Ayvansaray Kavşağı No: 41-43
Eyüp İstanbul TÜRKİYE
Tel: +90 212 395 11 00 | Fax: +90 212 395 11 11

SETA | Washington D.C. Office

1025 Connecticut Avenue, N.W., Suite 1106
Washington, D.C., 20036 USA
Tel: 202-223-9885 | Fax: 202-223-6099
www.setadc.org | info@setadc.org | @setadc

SETA | Berlin

Kronenstraße 1, 10117 Berlin GERMANY
berlin@setav.org

SETA | Bruxelles

Avenue des Arts 6, 1000 Bruxelles BELGIUM
Tel: +32 2 313 39 41

UNPACKING THE DEBATE ON TURKISH DRONES

Sibel Düz



SETA

SIYASET, EKONOMİ VE TOPLUM ARAŞTIRMALARI VAKFI
FOUNDATION FOR POLITICAL, ECONOMIC AND SOCIAL RESEARCH
مركز الدراسات السياسية والاقتصادية والاجتماعية

CONTENT

SUMMARY | 7

INTRODUCTION | 9

TRANSFORMATION IN MILITARY TECHNOLOGY
AND PRACTICES | 11

DRONE DIPLOMACY AND TURKEY'S QUEST
FOR MARKET SUPREMACY | 25

CONCLUSION | 37

SUMMARY

Turkey has made tremendous strides in developing indigenous unmanned aerial vehicles¹ and smart munitions in the last decade. This report will unpack the debates over Turkey's drone industry through the contribution of distinguished experts' comments and assessments. For this aim, several interviews on various sub-topics were conducted with relevant experts.² According to these interviews:

- *The military utilization of Turkish-made drones and munitions in several complex security environments attested to the capacity and capabilities of these products.*
- *Apart from the technological advancements, Turkey's unique concept of operation in which the unmanned and manned systems were employed jointly under the C2 structure of the TAF proved to be highly effective.*
- *Considering the growing reliance on autonomous, unmanned, and artificial intelligence-driven weapon systems, Turkey should adapt its military strategy and warfighting capabilities to these industry trends.*
- *Unmanned aerial swarm saturation attacks may be a very common military tactic, plus the concept of manned-unmanned teaming will play a crucial role in the future. In this respect, novel technologies equipped to handle difficult tasks will be extremely important for the TAF's future missions.*

¹ In this report, the terms of unmanned aerial vehicle (UAV), unmanned aerial systems (UAS), unmanned combat aerial vehicle (UCAV) and drone were used interchangeably.

² I specially thank the aforementioned experts for their contribution to this report.

- *The Nagorno-Karabakh conflict was one of the theatres of war that lent a glimpse into the future of battlegrounds in which UAS facilitate victory by establishing air dominance.*
- *In addition to revealing the unexpected vulnerabilities and overvalued competence of the Russian army, the Ukrainian TB2s have become a symbol of Ukrainian resistance.*
- *Stemming from the Turkish-made drones' overwhelming combat performance, the demand for those drones has multiplied rapidly. Multiple countries were added to the list that operates, orders, or has a possible interest in acquiring these platforms.*
- *There is certainly a need for clear international export controls and regulations on both commercial and military UAVs, acknowledging that drone proliferation across military and civilian spheres is unavoidable.*
- *In addition to providing operational flexibility to the TAF and projecting Turkey's military power, the Turkish-made drones also provided a number of political and economic opportunities and diplomatic benefits for Turkey. They have turned out to be strategic means for building a military cooperation model between Turkey and buyer countries, establishing a spill-over effect that has spread the relations in political, social, and economic spheres.*
- *Turkey will keep competing in the MALE drone sector, in which the most important producers are the U.S., Israel, and China. However, the new futuristic systems are whetting the appetite of highly developed countries. Not only in the Middle East, Africa, and Asian markets but also in the European market, there is room for Turkish-made products.*

In this report in the first section, the emerging unmanned military platforms and smart systems produced by Turkey and their impact on military norms and practices in several conflict areas will be discussed. In the second section, the questions of how these technologies are shaping Turkey's ties with buyer countries, trends, and competition in the drone market will be answered.

INTRODUCTION

On February 24, 2022, the world awoke to a new modern war that has changed the conventional wisdom on Turkish-made drones. Footage going viral on social media, showing Ukrainian Bayraktar TB2s destroying Russian armoured vehicles, air defence systems, howitzers, tankers, and trucks, manifested the military capability of indigenously built Turkish drones. It was Turkish-made drones with their modern features depicting the highly developed air defence systems archaic in Libya, Nagorno-Karabakh, and recently in Ukraine, a revelation that many military analysts are still refusing to admit.³

In Libya in 2019, the Turkish-made drones halted the advance of Khalifa Haftar, the commander of the Tobruk-based Libyan National Army (LNA), towards Tripoli, changing the trajectory of the conflict. Following Libya, in February 2020, Idlib became a perfect venue where Bayraktar TB2 and ANKA-S along with an array of EW systems were intensely used in a coordinated attack against Syrian regime forces.⁴ In Nagorno-Karabakh in 2020, the employment of Turkish-made Bayraktar TB2 UCAVs enabled the suppression of the sophisticated air defence

3 Ken Dilanian and Courtney Kube, “Why are Ukraine’s cheap, slow drones so successful against Russian targets?”, NBC News, 14 March 2022, <https://www.nbcnews.com/news/world/are-ukraines-cheap-slow-drones-successful-russian-targets-rcna19982>; Derek Gatopoulos and Suzan Fraser, “Cheap but lethal Turkish drones bolster Ukraine’s defenses”, ABC News, 17 March 2022, https://abcnews.go.com/International/wireStory/cheap-lethal-turkish-drones-bolster-ukraines-defenses-83498682?cid=social_twitter_abcn

4 Sibel Düz, “The Ascension of Turkey as a Drone Power | History, Strategy, and Geopolitical Implications”, SETA, 3 July 2020, <https://www.setav.org/en/analysis-the-ascension-of-turkey-as-a-drone-power-history-strategy-and-geopolitical-implications/>

systems of Armenia, which has turned out to be a great leap in modern warfare. Finally in Ukraine in 2022, TB2s have become a symbol of the Ukrainian military resistance narrative with lethal effectiveness against a highly advanced adversary.

Subsequently, the emerging unmanned military platforms, smart systems, and munitions manufactured by Turkey have become popular in the international defence market with countries lining up to acquire combat-proven military technologies.⁵

⁵ For a detailed discussion on Turkey's indigenous drone development program, please see Sibel Düz, "The Ascension of Turkey as a Drone Power | History, Strategy, and Geopolitical Implications", *SETA*, 3 July 2020, <https://www.setav.org/en/analysis-the-ascension-of-turkey-as-a-drone-power-history-strategy-and-geopolitical-implications/>

TRANSFORMATION IN MILITARY TECHNOLOGY AND PRACTICES

Turkey has made tremendous strides in developing indigenous unmanned aerial vehicles and smart munitions in the last decade. However, these platforms and systems gained worldwide attention when a novel and revolutionary combined air and ground operation was conducted against the Syrian regime forces during Operation Spring Shield on February 27, 2020. This operational success was followed by Libya and Nagorno-Karabakh, providing Turkey a highly prestigious reputation in the worldwide drone market. Currently, the military utilization of Turkish-made drones and munitions during the Ukrainian conflict have obviously attested to the capacity and capabilities of those products.

TABLE: AN EXAMPLE OF PRODUCT PORTFOLIOS		
	BASIC FLIGHT PERFORMANCE	ADVANCED FEATURES
 <p>BAYRAKTAR KIZILELMA (MIUS)</p>	<ul style="list-style-type: none"> 500 Nm Combat Radius 35,000 Feet Operational Altitude 5 Hours Endurance 6 Tons Maximum Take-Off Weight 0.6 Mach Cruise Speed 1.5 Tons Payload Capacity 	<ul style="list-style-type: none"> Fully Autonomous Take Off and Landing Low RCS High Maneuverability LOS and BLOS Take Off and Landing Capability from Short-Runway Aircraft Carriers High Situational Awareness with AESA Radar
 <p>BAYRAKTAR TB3</p>	<ul style="list-style-type: none"> 14 Meters Wingspan 8.35 Meters Length 2.6 Meters Height 1450 Kilograms Maximum Take Off Weight 125 knots-160 knots Cruise Speed - Maximum Speed 280 Kilograms Payload Capacity 24+ Hours Endurance 	<ul style="list-style-type: none"> Take Off and Landing Capability from Short-Runway Aircraft Carriers LOS and BLOS Fully Autonomous Take Off and Landing
 <p>BAYRAKTAR AKINCI</p>	<ul style="list-style-type: none"> 40,000 Feet Flight Altitude 24 Hours Airtime Dual Redundant SATCOM + Dual Redundant LOS Fully Automatic Flight Control and 3 Redundant Autopilot System (Triple Redundant) Fully Automatic Landing and Take-off Feature Without Dependence on Ground Systems Navigation with Internal Sensor Fusion Without Dependency on GPS 	<ul style="list-style-type: none"> Fully Automatic Navigation and Route Tracking Feature Precise Auto Takeoff and Landing with Built-in Sensor Fusion Fully Automatic Taxi and Parking Feature Semi-Autonomous Flight Modes Support Fault Tolerant and 3 Redundant Sensor Fusion Application Cross Redundant YKI System Unique Redundant Servo Actuator Units Unique Redundant Lithium-Based Battery Units
 <p>BAYRAKTAR TB2</p>	<ul style="list-style-type: none"> 18,000 Feet Operational Altitude 27 Hours Maximum Airtime Fully Automatic Flight Control and 3 Redundant Autopilot System (Triple Redundant) Fully Automatic Landing and Take-off Feature Without Dependence on Ground Systems Navigation with Internal Sensor Fusion Without Dependency on GPS 25,000 Feet Max Altitude 	<ul style="list-style-type: none"> Fully Automatic Navigation and Route Tracking Feature Precise Auto Takeoff and Landing with Built-in Sensor Fusion Fully Automatic Taxi and Parking Feature Semi-Autonomous Flight Modes Support Fault Tolerant and 3 Redundant Sensor Fusion Application Cross Redundant YKI System Unique Redundant Servo Actuator Units Unique Redundant Lithium-Based Battery Units
 <p>BAYRAKTAR VTOL UAV</p>	<ul style="list-style-type: none"> 150 Kilometer Communication Range Travel Speed 45-50 Knots 80 Knots Max Speed 9000 Feet Operational Altitude 15000 Feet Altitude Ceiling 12 Hours Airtime 5 Meter Wingspan 1.5 Meter Length Vertical Take-off 5 Kilogram Payload Capacity 50 Kilograms Maximum Takeoff Weight 	<ul style="list-style-type: none"> Fully Automatic Flight System Fully Autonomous with Sensor Fusion Assisted Autonomous Takeoff and Landing System Semi-Autonomous Flight Mode Fault Tolerant System Architecture Three Redundant Flight Control System Redundant Servo Actuators Electro-Optical (EO) Camera Module Infrared (IR) Camera Module Laser Rangefinder
 <p>BAYRAKTAR MINI UAV</p>	<ul style="list-style-type: none"> Modular Design Easy Assembly Feature Carbon Fiber, Kevlar Composite Construction Shock Absorber Body Structure Original Parachute Design Portable Structure in a Portable Bag Fuselage, Multi-Part Wing Structure, Tail Wings 	<ul style="list-style-type: none"> Automatic Target Point Tracking Automatic Overhead Landing/Automatic Parachute Landing Joystick Assisted Semi-Automatic Flight Stall Speed Control Capability Spin Control Feature in Hard and Blow Windy Weather Reliable Digital Communication System Automatic Return to Home and Automatic Landing in Case of Communication Loss Multiple UAV Command / Control / Tracking Support Smart Battery Management System Remote Command Control and Monitoring Function (Client Server Architecture) Ability to Change Ground Control Station Auto Takeoff and Cruise

Source: BAYKAR

	BASIC FLIGHT PERFORMANCE	ADVANCED FEATURES
 <p>ANKA</p>	<ul style="list-style-type: none"> ■ Endurance: 30+ Hours @ Mission Altitude ■ Service ceiling: 30,000 ft (MSL) ■ Typical Mission Altitude: 18,000 – 23,000 ft ■ Datalink range: 250+ km ■ Powerplant: Heavy Fuel Engine ■ Payload Capacity: 350+ kg ■ MTOW: 1,700 kg 	<ul style="list-style-type: none"> ■ Fully autonomous operation ■ Redundant flight control system ■ Redundant automatic take - off and landing system (DGPS and radar) ■ Redundant electrical power generation - Redundant high data rate digital datalink (44 Mbps) ■ DO178B certified software (DO-254 certified flight critical hardware) ■ Encrypted communication (Comsec & Transec) ■ Emergency base landing capability (Option for takeoff) ■ Return home and land capability for total link loss during emergency ■ Cost effective, sustainable life cycle - Heavy fuel propulsion ■ Retractable landing gear ■ Back up emergency batteries ■ Enhanced capability with new developing and more powerful engine ■ Sustainable flight sensor and payloads for heavy jamming conditions ■ High Capacity Telemetry and Payload Data Recorder
 <p>AKSUNGUR</p>	<ul style="list-style-type: none"> ■ Endurance: 50 hours ■ Service Ceiling: 40,000 ft (MSL)* ■ Payload Capacity: 750+ kg ■ Max. Takeoff Weight: 3,300 kg ■ Datalink Range: 250+ km ■ Engine Type: PD-170 Dual Turbo Diesel ■ Engine Power: 2x170 HP (SL, ISA)* ■ Ground Attack/Maritime Mission: 12 hours at 25k ft with 750 kg 	<ul style="list-style-type: none"> ■ Fully autonomous operation ■ Redundant automatic flight control system ■ Redundant automatic take-off and landing system ■ Redundant electrical power generation system ■ Redundant digital datalinks with encryption ■ DO-178B compliant software ■ DO-254 compliant hardware ■ GCS and datalink compatibility with existing ANKA UAV systems ■ Ice protection system (optional) ■ Beyond Line of Sight (BLOS) operation flexibility with SATCOM (optional)

Source: TUSAS

	CAPABILITIES	TECHNICAL FEATURES
 <p>TOGAN</p>	<ul style="list-style-type: none"> ■ Reliable Day and Night Operation ■ Real-Time Mobile or Static Target Recognition and Tracking ■ Fully Autonomous Operation Capability ■ Ability to perform autonomous change of duty among two or more active platforms ■ High Performance, customized flight control and mission planning software ■ Deployable and Operable by Single Personnel ■ 3 Axis, stabilized 30x Electro-Optical Imaging Pod ■ 3 Axis Stabilised IR POD for night missions ■ Integrated 3 Axis EO and IR POD (Optional) 	<ul style="list-style-type: none"> ■ Range: 5/10 km ■ Endurance: < 45 minutes ■ Payload: 3-Axis Stabilized Gimbal Electrical ■ Engine: Electrical ■ Launch/ Take Off: Vertical Take Off / Landing (VTOL)
 <p>KARGU</p>	<ul style="list-style-type: none"> ■ Day & Night Mission Capability ■ Precision Strike with minimum collateral damage ■ Low RCS (Radar Cross Section) Platform Design ■ Multiple Warhead Options ■ Optical and Physical Target Tracking ■ High performance, autonomous navigation and flight control system ■ Operable by single personnel ■ Mission abort and return home capabilities ■ STM designed proximity fuse ■ STM designed Automatic Target Recognition System 	<ul style="list-style-type: none"> ■ Communication Range: 5/10km ■ Endurance: 30 minutes ■ Payload Capacity: 1,3 kg ■ Engine: Electrical ■ Launch / Take off: Vertical Take Off / Landing (VTOL)
 <p>ALPAGU</p>	<ul style="list-style-type: none"> ■ Reliable Day and Night Operation ■ Autonomous precision strike with minimum collateral damage ■ Tracking Moving Targets ■ High Performance Navigation, Flight Control and Guidance Algorithms ■ Deployable and Operable by Single Soldier ■ In-Flight Mission Abort and Emergency Self-Destruction Modes ■ Advanced and Indigenous Electronic Ammunition ■ Safety, Setup and Trigger Systems ■ Indigenous National Embedded Hardware and Software ■ Wide Lateral View Angle ■ Image Processing-Based Control Applications ■ Embedded and Real-Time Object Tracking, Detection and Classification 	<ul style="list-style-type: none"> ■ Operational Range: < 10 km ■ Mission Endurance: 15 minutes ■ Warhead: < 0.3 kg ■ Engine: Electrical ■ Launch Method: Phnematik Kanister
 <p>BOYGA</p>		<ul style="list-style-type: none"> ■ Dimensions: 800x800x500 mm ■ Diagonal Length: 1150 mm ■ Communication Range: 5 km ■ Weight: 15 kg ■ Take Off Weight: 17 kg ■ Endurance: 30 min. ■ Max. Operating Altitude: 3000 mt (MSL) ■ Max. Cruise Speed: 54 km/h ■ Max. Wind Resistance: 10 m/sn

Source: STM

  <p>KARAVEL-SU</p>	<p>BASIC FLIGHT PERFORMANCE</p> <ul style="list-style-type: none"> ■ Design compatible with STANAG 4671 ■ Lightning protection ■ Pneumatic De-icing system ■ Triple redundant avionics architecture ■ Automatic take-off/flight/landing system ■ AVGAS 100 LL ■ Composite fuselage and main structure ■ 70 kg payload capacity at the CG ■ 120 kg payload capacity under the wings ■ 20 hours endurance with payload ■ 22.500 ft operation altitude ■ 200 km line of sight (LOS) ■ Satellite control (SATCOM) BLOS ■ GCS/GDT transfer 						
<p>Source: LENTATEK</p>							
  <p>MAM-C SMART MICRO MUNITION</p>  <p>MAM-T MUNITION</p>  <p>MAM-L SMART MICRO MUNITION</p>	<p>ADVANCED FEATURES</p> <table border="0"> <tr> <td> <ul style="list-style-type: none"> ■ Diameter: 70 mm ■ Length: 970 mm ■ Weight: 6,5 kg ■ Range: 8 km ■ Guidance: Laser Seeker ■ Platforms: UAVs Light Attack Aircraft </td> <td> <ul style="list-style-type: none"> ■ Warhead Type: Multi-purpose Warhead** Blast Fragmentation, Armour piercing and Incendiary) High Explosive Blast Fragmentation ■ Types of Targets: Light Armored / Unarmored Vehicles Anti-Personnel </td> </tr> <tr> <td> <ul style="list-style-type: none"> ■ Diameter: 230 mm ■ Length: 1.4 m ■ Weight: 95 kg ■ Range: UAV - 30+ km </td> <td> <ul style="list-style-type: none"> ■ Guidance: Laser Seeker ■ Warhead Type: Blast Fragmentation Warhead ■ Platform: Unmanned Aerial Vehicles [UAV], Light Attack Aircraft </td> </tr> <tr> <td> <ul style="list-style-type: none"> ■ Diameter: 160 mm ■ Length: 1 m ■ Weight: 22 kg ■ Range: 15 km ■ Guidance: Laser Seeker ■ Fuze Type: Impact / Proximity </td> <td> <ul style="list-style-type: none"> ■ Warhead Type: Armour piercing High Explosive Blast Fragmentation, Thermobaric ■ Types of Targets: Main Battle Tanks, Light Armoured Vehicles, Personnel ■ Platforms: UAVs, Light Attack Aircraft </td> </tr> </table>	<ul style="list-style-type: none"> ■ Diameter: 70 mm ■ Length: 970 mm ■ Weight: 6,5 kg ■ Range: 8 km ■ Guidance: Laser Seeker ■ Platforms: UAVs Light Attack Aircraft 	<ul style="list-style-type: none"> ■ Warhead Type: Multi-purpose Warhead** Blast Fragmentation, Armour piercing and Incendiary) High Explosive Blast Fragmentation ■ Types of Targets: Light Armored / Unarmored Vehicles Anti-Personnel 	<ul style="list-style-type: none"> ■ Diameter: 230 mm ■ Length: 1.4 m ■ Weight: 95 kg ■ Range: UAV - 30+ km 	<ul style="list-style-type: none"> ■ Guidance: Laser Seeker ■ Warhead Type: Blast Fragmentation Warhead ■ Platform: Unmanned Aerial Vehicles [UAV], Light Attack Aircraft 	<ul style="list-style-type: none"> ■ Diameter: 160 mm ■ Length: 1 m ■ Weight: 22 kg ■ Range: 15 km ■ Guidance: Laser Seeker ■ Fuze Type: Impact / Proximity 	<ul style="list-style-type: none"> ■ Warhead Type: Armour piercing High Explosive Blast Fragmentation, Thermobaric ■ Types of Targets: Main Battle Tanks, Light Armoured Vehicles, Personnel ■ Platforms: UAVs, Light Attack Aircraft
<ul style="list-style-type: none"> ■ Diameter: 70 mm ■ Length: 970 mm ■ Weight: 6,5 kg ■ Range: 8 km ■ Guidance: Laser Seeker ■ Platforms: UAVs Light Attack Aircraft 	<ul style="list-style-type: none"> ■ Warhead Type: Multi-purpose Warhead** Blast Fragmentation, Armour piercing and Incendiary) High Explosive Blast Fragmentation ■ Types of Targets: Light Armored / Unarmored Vehicles Anti-Personnel 						
<ul style="list-style-type: none"> ■ Diameter: 230 mm ■ Length: 1.4 m ■ Weight: 95 kg ■ Range: UAV - 30+ km 	<ul style="list-style-type: none"> ■ Guidance: Laser Seeker ■ Warhead Type: Blast Fragmentation Warhead ■ Platform: Unmanned Aerial Vehicles [UAV], Light Attack Aircraft 						
<ul style="list-style-type: none"> ■ Diameter: 160 mm ■ Length: 1 m ■ Weight: 22 kg ■ Range: 15 km ■ Guidance: Laser Seeker ■ Fuze Type: Impact / Proximity 	<ul style="list-style-type: none"> ■ Warhead Type: Armour piercing High Explosive Blast Fragmentation, Thermobaric ■ Types of Targets: Main Battle Tanks, Light Armoured Vehicles, Personnel ■ Platforms: UAVs, Light Attack Aircraft 						
<p>Source: ROKETSAN</p>							

How will emerging unmanned platforms, smart systems, and munitions impact Turkey’s warfighting capabilities and military strategy in the future?

On the current effect of the abovementioned platforms and munitions on the Turkish Armed Forces’ (TAF) warfighting capabilities, **Mr. Feridun Tasdan**, a professor at Western Illinois University elaborates that the operational use of the UAVs changes in compliance with the operational requirements. As the UAVs can be utilized for Intelligence, Surveillance, and Reconnaissance (ISR) missions, the UAVs can also be operated under the banner of the novel “search and destroy” concept. Mr. Tasdan explains this novel operational concept as: “Several UAVs

work together in this concept as one UAV works as a ISR platform to find ground targets and the other UAV(s) orbiting nearby engages the designated targets with guided munitions.” Mr. Tasdan also points out Turkey’s unique concept of operation in which the unmanned and manned systems were employed jointly under the Command and Control (C2) Structure of the TAF. *“Joint employment of the unmanned and manned systems (Fighters, Air Defense Units, Airborne Early Warning (AEW) and Electronic Warfare (EW) Systems) by the TAF proved to be highly effective and decisive in reaching the goals of the military operations. A wide range of guided munitions including very light weight (14 kg MAM-C, 22.5 kg MAM-L) to a heavy weight guided bombs and long-range missiles (TEBER, HGK-82/84, LGK-82/84, KGK-82/83 and SOM-A/B/J) produced by Turkish defence companies, completed the pieces of the puzzle for Turkey’s grand strategy of self-reliance on weapon systems.”* Moreover, according to Mr. Tasdan, considered as “a force multiplier” the availability of these smart munitions in large quantities and local manufacturing capabilities are significantly important to sustain the military operations without supply chain and logistical problems.

Regarding future capabilities, Mr. Tasdan remarks that: *“A good example of how an unmanned system would bring new capabilities to achieve a mission without risking human lives or expensive manned platforms can be seen from Turkish Navy’s deployment of its new drones such as TB2, ANKA and AKSUNGUR for long endurance (15-20 hours durations) sea control and surveillance missions in Aegean and the Mediterranean Seas. This capability gives Turkish Navy an ability to constantly observe seas around Turkey, detect any hostile activities and report (via live video stream) any ship movements to the Command-and-Control Centres of the TAF.”*

However, assuming that the drones would be intensely used in future wars, considering the already growing reliance on autonomous, unmanned, and artificial intelligence (AI)-driven weapon systems, Turkey should adapt its military strategy and warfighting capabilities to these industry trends. **Mr. Felix Woesnerr**, a defence analyst in Berlin, envisages that: *“The increasing level of autonomy in weapon systems does not only affect the Turkish military but all countries. The increased use of AI in weapon systems makes combat situations faster, thus increasing the importance of the time factor. Whoever acts faster in the kill chain will dominate the battlefield. Countries like Russia or China actively develop fully autonomous weapons. Military strategy of other countries will therefore have to adapt to these technological trends and strategies in the future.”* In Turkey, the KARGU Autonomous Tactical Multi-Rotor UAV, the ALPAGU Autonomous Tactical Fixed-Wing

UAV, and the TOGAN Autonomous Multi-Rotor UAV developed by STM are pioneering examples of emerging technologies with autonomous navigation, surveillance, and reconnaissance abilities. In June 2021, a U.N. report addressing the Security Council on Libya speculated that Kargu-2 under the command of GNA forces targeted the LNA forces “without requiring data connectivity between the operator and the munition: in effect, a true ‘fire, forget and find’ capability,” which may point to the first human casualty led by an autonomous robots offensive.⁶ However, STM denied that allegation, stating that the Kargu-2 is not capable of launching fully autonomous attacks on targets.⁷

Do you believe that drones are uniquely equipped to handle 3-D (dull, dirty, and dangerous) tasks? How can they be utilized as air power assets in military operations?

On the flip side, some experts envisage that robots may take over the dull, dirty, and dangerous tasks from humans, known as the 3-D tasks. In fact, robots are uniquely able to perform repetitive tasks necessitating low interaction, also beneficial when handling unfavourable tasks risking human health, and can work without risking human lives. Likewise, the UAVS are better equipped to handle difficult tasks, the 4th D, requiring a low margin of error, removing the miscalculation factor due to the human vulnerabilities. According to Mr. Woesnerr: *“In cooperation with the Unmanned Ground Vehicles (UGV), small drones can move into dangerous areas without endangering human forces. The concept of ‘manned-unmanned teaming (MUM-T)’ will play a crucial role in future mission scenarios, that is, the UAS connected by a distributed network of AI will act as force multipliers for the manned aircraft, so MUM-T can take over the most high-risk tasks of a mission. Furthermore, saturation attacks with swarms of autonomous loitering munitions might be a very common military tactic in the future.”*

Similarly, Mr. Tasdan adds that: *“If you ask a military commander, how he/she wants to execute a mission that is assessed to be very risky mission due to the strong enemy defences and fortifications, most probably he/she will choose to proceed with unmanned systems supported by the manned systems. In the future, we will see more*

⁶ “Letter dated 8 March 2021 from the Panel of Experts on Libya established pursuant to resolution 1973 (2011) addressed to the President of the Security Council, UN, 8 March 2021, <https://documents-dds-ny.un.org/doc/UNDOC/GEN/N21/037/72/PDF/N2103772.pdf?OpenElement>

⁷ Sinan Tavşan, “Turkish defense company says drone unable to go rogue in Libya”, *Nikkei Asia*, 20 June 2021, <https://asia.nikkei.com/Business/Aerospace-Defense/Turkish-defense-company-says-drone-unable-to-go-rogue-in-Libya>

stealthier drones (smaller to a larger scale) to penetrate deeper into enemy territories to perform its missions. We will also see smaller size drones operating in 'swarm' concept to saturate the enemy air defences and destroy intended targets. In this respect, BAYKAR's MIUS (jet-powered, low observable UAV) would be extremely important for the TAF future missions against well-defended areas."

What's the buzz on Turkish EW Systems? Acknowledging that drones are becoming a crucial component of a network-centric warfare, how have those EW systems contributed to indigenously built Turkish drones' successes in complex security? environments?

Despite the proven capabilities of Turkish-made drones in complex security environments, Turkish drones are not free from vulnerabilities, especially when operating in non-permissive airspace. However, coordinated electronic and network warfare capabilities have collaborated to overcome those vulnerabilities.

To establish airspace for drone operations, the threats from the enemy's combat aircraft, surface-to-air missiles (SAM), and electronic warfare systems should be dealt with. Only after the air dominance or air supremacy is established, can SEAD/DEAD (Suppression and Destruction of Enemy Air Defences) campaigns⁸ against SAMs be initiated to suppress the enemy's radars and prevent guided-missile engagements. Acknowledging that drones and EW assets are becoming crucial components of network-centric warfare, Mr. Tasdan argues that to get the maximum benefit from the drones, the TAF has been investing in a variety of indigenously built EW systems⁹. *"Open-source intelligence revealed that during Operation Spring Shield in Idlib-Syria, the TAF operated SIGINT/ELINT aircraft and KORAL/REDET systems to support Turkish drone operations by locating and jamming Syria SAM systems, in which some of them were mobile Pantsir SAM systems. If there have been no EW support or geolocation information of the hostile SAMs, it would have been very risky for drones to conduct their operations alone or to find Syrian SAMs over the battlefield."*

8 According to the DOD Dictionary of Military and Associated Terms, SEAD is defined as "Activity that neutralizes, destroys, or temporarily degrades surface-based enemy air defenses by destructive and/or disruptive means." Retrieved from <https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/dictionary.pdf>

9 According to the information shared by the interviewee, these EW systems range from SIGINT/ELINT aircraft to a land based REDET-I/II and KORAL EW systems. REDET and KORAL EW Systems have two components: ESM (Electronic Support Measures) and EA (Electronic Attack). The ESM system can collect information about the hostiles radars operating in the area and then transfer the information to the EA vehicles. Then the EA systems perform appropriate jamming techniques (including very advance DRFM-digital radio frequency memory technique) against the hostile radars.

How did emerging unmanned platforms, smart systems, and munitions produced by Turkey impact Azerbaijan's warfighting capabilities and military strategy during the Nagorno-Karabakh conflict? Were they successful against Armenian targets? Which lessons can be learned for the Armenian defence industry and counter-drone measures?

The Nagorno-Karabakh conflict was one of the theatres of war that demonstrated the transformation of military norms and practices by Turkish-made unmanned aerial systems. In September 2020, the Azerbaijani UAV fleet, consisting of Turkish-made Bayraktar TB2 UCAVs, conducted a lethal campaign against Armenian military assets varying from tanks, armored fighting vehicles, artilleries, rocket launchers, trucks and air defence systems to radars.¹⁰ The Nagorno-Karabakh conflict hinted to a futuristic battleground in which a war may be conducted via unmanned systems and electronic warfare assets. Also, the Nagorno-Karabakh conflict was pioneering in the sense that unmanned aerial systems facilitated Azerbaijan's victory by establishing air dominance, deluding many into a winnable war from the air.¹¹ In addition, footage showing Armenian forces turned out to be impotent against Azerbaijan's UAV offences revealed that Azerbaijan's UAVs remained undetected even at a close distance to Armenian radars. Furthermore, the location of the Armenian air defence systems was spotted by sending unmanned decoys, and the Azerbaijani UAV fleet wiped them out with kinetic strikes. After establishing air dominance, a broad range of land warfare assets were destroyed by systematic strikes, as well.

According to **Mr. Agil Rustamzade**, a military expert from Azerbaijan, in the Nagorno-Karabakh conflict, the drone strikes destroyed 63% of all military assets of Armenian units, a claim based on estimated data. Therefore, it can be said that the lethal and destructive effects of the combat drones were not limited to just the conflict, but they also led to incapacitating the Armenian defence industry, as well. He says: *"The combat drones were very successful against the Armenian troops such that during the 44 days of the war they were unable to find any effective means of fighting against them. Armenia is not a country with a high-tech defense industry, they are trying to develop electronic warfare systems, but due to the lack of financial resources and necessary technological infrastructure, they haven't got good*

10 Stijn Mitzer and Joost Oliemans, "The Conqueror of Karabakh: The Bayraktar TB2", *Oryxspioenkop*, 27 September 2021, <https://www.oryxspioenkop.com/2021/09/the-conqueror-of-karabakh-bayraktar-tb2.html>

11 Uzi Rubin, "The Second Nagorno-Karabakh-War: A Milestone in Military Affairs", *BESA Center*, 16 December 2020, <https://besacenter.org/nagorno-karabakh-war-milestone/>

results, yet.” Another expert, **Mr. Anıl Sahin**, the chief editor of Savunma SanayîST platform in Turkey, highlights the crucial contribution of the EW systems by stating: *“The Karabakh Operation led to question the war strategies of not only Azerbaijan, but also other countries. On modern battlefields, once again, electronic attack, electronic support, and integrated air defence systems (IADS) have proven to be an absolute necessity. If you have advanced electronic-support systems, you can determine the engagement and detection ranges of air defence systems and position your air platforms in the field relying on this adopted data. If you are potent in the electronic attack, you can open a channel for your aerial platforms in the field. We have seen in Karabakh what may happen in the absence of these, and we will continue to see it in Ukraine.”*

How have emerging unmanned platforms, smart systems and munitions produced by Turkey impacted Ukraine’s warfighting capabilities and military strategy during the Ukrainian conflict? Are they successful against Russian targets? What lessons can be learned about the Russian defence industry and counter-drone measures?

The other theatre of war in which Turkish-made unmanned aerial systems have been overwhelming a high-end adversary is Ukraine. In the opening stages of the war, several video footages circulating on social media displayed the devastating impact of Ukrainian TB2 strikes on Russian military assets on what appeared to be armoured vehicles, howitzers, surface-to-air missile systems worth up to \$50 million¹², fuel convoys and supply trucks. In addition to revealing the unexpected vulnerabilities or overvalued competence of the Russian army, Ukrainian TB2s have become a symbol of Ukrainian resistance by boosting the morale of the army and people, even serving as an inspiration for songs.

The experts and analysts expecting the TB2 to be dysfunctional in contested airspace or an easy target for the Russians were surprised by the performance of Ukrainian TB2s. Actually, the lethal and accurate strikes of the TB2s should not confuse the analysts or military experts considering the Russian vulnerabilities.

To begin with, at the onset of the war it can easily be determined that the Russian army acted out of its regular TTPs (Tactics, Techniques, and Procedures), covering the deployment of layered short, medium, long-range SAM systems, and

12 Billy Perrigo, “Ukraine’s Secret Weapon Against Russia: Turkish Drones”, *Time*, 1 March 2022, <https://time.com/6153197/ukraine-russia-turkish-drones-bayraktar/>

potent EW systems. Unexpectedly, Russia hasn't made use of advanced electronic warfare or has been unable to conduct air patrols to establish air superiority, which led to a struggle to hunt the TB2s, as well. Secondly, sub-standard coordination between the Russian Armed Forces and the poor state of maintenance and logistical issues made the Russian army vulnerable to ambushes and strikes. The Russian advance beyond the coverage of SAM systems, poorly coordinated air defence coverage, and risk of disrupting its own communication systems by using jamming capabilities provided opportunities for TB2 strikes.¹³

Although the TB2 is not an invincible or stealthy military technology, older SAM radars have struggled to detect and track TB2s flying with relatively small RCS (Radar Cross-Section) and cruising speed. TB2 operators have been flying the drones at low altitude, below the horizon of long-range radars, to attack. Small, quiet, and not overly hot, TB2s have become hard to detect for radars and infrared sensors.¹⁴

Moreover, SATCOM integration provides a larger range than LOS – between 150-300 km, satellite communication capability, and alleged access permission to TURKSAT satellites, which help to greatly reduce the limitations on TB2's control range.¹⁵ Reportedly, in October 2019, the communication range between the Bayraktar TB2 and the ground control station was increased from 150 km to 300 km, but there is no clear information on whether this capability has been integrated into the TB2s in the service of the Ukrainian Armed Forces.¹⁶ Besides, Aerorozvidka's drone unit has destroyed "priority targets" in nighttime raids and operated the Starlink satellite system so they can operate regardless of internet outages or power failures.¹⁷

Lastly, the unique capability of the TB2s to work as a high-class artillery fire adjustment system was recently demonstrated by the TB2's ability to detect the

13 Justin Bronk, "Why hasn't Russia been able to stop Ukraine's drone attacks? ", *The Spectator*, 16 March 2022, <https://www.spectator.co.uk/article/why-can-t-russia-stop-ukraine-s-air-attacks->

14 Derek Gatopoulos and Suzan Fraser, "Cheap but lethal Turkish drones bolster Ukraine's defenses", *ABC News*, 17 March 2022, https://abcnews.go.com/International/wireStory/cheap-lethal-turkish-drones-bolster-ukraines-defenses-83498682?cid=social_twitter_abcn

15 David Axe, "Ukraine's Drones Are Wreaking Havoc On The Russian Army ", *Forbes*, 21 March 2022, <https://www.forbes.com/sites/davidaxe/2022/03/21/ukraines-drones-are-wreaking-havoc-on-the-russian-army/?sh=27483ca318b6>

16 İbrahim Sünnetçi, "BAYRAKTAR TB2 SİHA ve Rus-Ukrayna Savaşı", 1 March 2022, <https://www.linkedin.com/pulse/bayraktar-tb2-siha-ve-rus-ukrayna-sava%C5%9F%C4%B1-ibrahim-s%C3%BCnnetci/>

17 Alia Shoaib, "An elite Ukrainian drone unit exploits the cover of night to destroy Russian tanks and trucks while their soldiers sleep, report says", *Business Insider*, 20 March 2022, <https://www.businessinsider.com/ukrainian-drone-unit-strikes-russian-targets-while-they-sleep-the-times-2022-3#:~:text=A%20Ukrainian%20drone%20unit%20has,drones%20to%20destroy%20Russian%20equipment.>

target and transmit its coordinates to the artillerymen at a distance of 48 km from the target.¹⁸

According to **Mr. Samuel Bendett**, Adjunct Senior Fellow at CNAS and an Adviser at CNA, the Ukrainian experience has convinced Russia of the utility of combat UAVs in modern warfare as such like previously in Syria: *“Russian military is again re-learning this lesson in Ukraine, even as it showcases more and more of its own combat drones like Forpost-R and Orion launching strikes against Ukrainian targets. And the Russian military claimed before this war that it would be able to counter TB2s with sophisticated counter-drone capability, which was very slow to materialize in the first several weeks of this invasion. That the Turkish drones are still able to conduct strikes against Russian forces speaks to the need to have the C-UAS technology up front, at the tactical edge, something that the Russia clearly lacked early in the war.”*

What’s the buzz on commercial drones? What could be their potential military impact on the Ukrainian conflict?

Other than combat drones, interestingly, it was discovered that consumer-grade drones can also be used for documenting war crimes, attacks, or citizen journalism, or even re-configured for weaponized usage to drop IEDs or grenades onto enemies or to monitor Russian army manoeuvres.

Ms. Faine Greenwood, Humanitarian Technology Researcher, and Writer, states that Ukraine has frequently used commercial drones for surveillance, targeting, and documentation purposes, and is using them less extensively for physical attacks using small explosives. Ms. Greenwood emphasizes, *“Commercial drones are also being used to document human rights violations, like a recent video in which a Ukrainian soldier assigned to monitor Russian movements with a small DJI Mavic drone captured footage of Russian forces apparently shooting a civilian.”*¹⁹ Ms. Greenwood warns that there is a need for legal regulations since the commercial drones look identical and are being used by various parties, and it creates significant danger for drone users in Ukraine, including civilians.

18 “The Armed Forces of Ukraine Have Demonstrated Bayraktar TB2 UAV’s Unique Capabilities”, *Defense Express*, 19 March 2022, https://en.defence-ua.com/weapon_and_tech/the_armed_forces_of_ukraine_have_demonstrated_the_real_capabilities_of_bayraktar_tb2-2320.html

19 Nick Allen, “Drone footage appears to show Russian soldiers shooting civilian with his hands up in Ukraine”, *Telegraph*, 16 March 2022, <https://www.telegraph.co.uk/world-news/2022/03/16/drone-footage-appears-show-russian-soldiers-shooting-civilian/>

On the other hand, Mr. Bendett believes that commercial drones like the Chinese DJI used in Ukraine may add additional capacity for armies. Mr. Bendett added: *“Commercial drones do not come with many countermeasures and defenses, and the Russian military has claimed prior to this war that it has c-UAS and EW technology that can identify and jam such drones in battle. Looking at some social media posts, it’s clear that the Russian military does not always field such defenses, with Ukrainian drones able to film and conduct their own strikes at Russian positions. In other cases, Russian military is able to deal with such commercial UAVs. It’s likely that in the future, commercial drones may become a key part of practically any conflict, with both attackers and defenders fielding this technology to augment their more sophisticated military weapons and systems.”*

DRONE DIPLOMACY AND TURKEY'S QUEST FOR MARKET SUPREMACY

Stemming from the Turkish drones' overwhelming combat performance, the demand for those drones, especially for Baykar-made TB2s, has multiplied rapidly. Recently, Selçuk Bayraktar, the chief technology officer of the Baykar company, announced that export contracts had been signed with 19 countries, and many deliveries were in progress. Turkey is among the top three countries exporting unmanned aerial vehicles.²⁰ According to open sources, other than Qatar, Ukraine, Azerbaijan, and Libya, multiple countries were also added to the list, which operates, orders, or has a possible interest in acquiring these systems.

In June 2021, Latvian Minister of Defense Artis Pabriks paid a visit to Baykar Defense's Production Facilities and stated their interest in acquiring TB2s on Twitter.²¹ Likewise, in August 2021, Iraqi Minister of Defence Jumah Enad Sadoon, stated that they "reached an agreement" on the TB2, "intend" to purchase 12 T-129 ATAK helicopters, and have a "purchase offer" for six electronic warfare systems from Turkey.²²

20 Şahin Oktay, "Baykar Teknoloji Lideri Bayraktar: Baykar, şu anda dünyada en fazla ülkeye insansız hava aracı ihraç etmiş firma", *Anadolu Agency*, 8 March 2022, <https://www.aa.com.tr/tr/bilim-teknoloji/baykar-teknoloji-lideri-bayraktar-baykar-su-anda-dunyada-en-fazla-ulkeye-insansiz-hava-araci-ihrac-etmis-firma/2527855>

21 Kamer Kurunç, "Letonya Savunma Heyetinden Bayraktar TB2 Ziyareti", *Savunma SanayîST*, 7 June 2021, <https://www.savunmasanayist.com/letonya-savunma-heyeti-bayraktar-tb2/>

22 Kamer Kurunç, "Irak'tan Bayraktar TB2, T129 ATAK ve EH Sistemleri Açıklaması", *Savunma SanayîST*, 28 August 2021, <https://www.savunmasanayist.com/irak-bayraktar-tb2-t129-atak/>

In September, TB2s were exhibited for the first time at the military parade held for the 30th anniversary of Turkmenistan's independence.²³ Similarly, a Bayraktar TB2 was seen in the skies of Morocco in November, confirming the 13 Bayraktar TB2 orders previously done for the Royal Moroccan Air Force.²⁴

In December, Bayraktar TB2s, under the service of the Border Service of the Kyrgyz Republic, were deployed at Jalal-Abad Airport.²⁵ Moreover, Somalia-based news agency the Daily Jubba claimed that Somalia received the first Bayraktar TB2s.²⁶ However, any information on the use of Turkish-made drones by Turkish military personnel stationed at Camp TURKSOM military base, or the acquisition of Turkish-made drones by Somalia needs confirmation.

In mid-March 2022, Niger President Mohamed Bazoum paid a visit to Baykar facilities to examine the latest status of Bayraktar TB2s ordered by his country.²⁷ Recently, in a video clip released by Pakistan reflecting the Air Force's future concept, Bayraktar TB2s and AKINCI UCAVs²⁸ were spotted. In fact, there were rumours that Pakistan had ordered Bayraktar TB2s, even a patch was shared confirming that Pakistan had been supplied Bayraktar TB2s from Turkey. On the other hand, whether Pakistan has ordered AKINCI UCAV or not hasn't been confirmed, yet.²⁹ According to the statement made by Baykar Defense CEO Haluk Bayraktar on Twitter, export contracts were signed with two countries for AKINCI UCAV.³⁰

23 "Türkmenistan'a Bayraktar TB2 İhracatı", *Savunma SanayîST*, 27 September 2021, <https://www.savunmasanayist.com/turkmenistana-bayraktar-tb2-ihracati/>

24 "Bayraktar TB2 SİHA Fas Semalarında", *Savunma SanayîST*, 5 November 2021, <https://www.savunmasanayist.com/bayraktar-tb2-siha-fas-semalarinda/>

25 Kamer Kurunç, "Kırgızistan'ın Bayraktar TB2 SİHA'ları Göreve Başladı", *Savunma SanayîST*, 18 December 2021, <https://www.savunmasanayist.com/kirgizistanin-bayraktar-tb2-sihaları-goreve-basladi/>

26 "Daily Jubba sources have just confirmed that Somalia has received its first shipment of Bayraktar TB2 Drones. A special battalion will also be trained with the purpose of attacking positions while using the drones as air support. This is a new battalion separate from Gorgor.", *Daily Jubba Twitter*, 9 December 2021, <https://twitter.com/DailyJubba/status/1469026386379952128?s=20&t=6UG6OpFi3NPlc38tNsMAOW>

27 Kamer Kurunç, "Nijer Cumhurbaşkanı Türk Savunma Sanayii Şirketlerini Gezdi", *Savunma SanayîST*, 11 March 2022, <https://www.savunmasanayist.com/nijer-cumhurbaşkanı-türk-savunma-sanayii-sirketlerini-gezdi/>

28 For detailed information on AKINCI UCAV please see Sibel Düz, "Q&A: Bayraktar AKINCI UCAV | A New Period in Unmanned Air Warfare", *SETA*, 3 September 2021, <https://www.seta.org/en/qa-bayraktar-akinci-ucav-a-new-period-in-unmanned-air-warfare/>

29 Kamer Kurunç, "Pakistan'dan AKINCI TİHA ve Bayraktar TB2 Mesajı", *Savunma SanayîST*, 11 March 2022, <https://www.savunmasanayist.com/pakistan-dan-akinci-tiha-ve-bayraktar-tb2-mesaji/>

30 Kamer Kurunç, "AKINCI Taarruzi İHA Bir Ülkeye Daha İhrac Edildi", *Savunma SanayîST*, 2 March 2022, <https://www.savunmasanayist.com/akinci-taarruzi-ih-a-bir-ulkeye-daha-ihrac-edildi/>

After the outbreak of the Ukrainian conflict, Turkey's UAV delivery to Poland is in the limelight. Actually, the first unit of TB2s is expected to be delivered by October 31, 2022, to Poland.³¹

TAI, another leading company in the Turkish drone industry, has been conducting negotiations in the Asian market for a while. The first customer of ANKA UAV produced by TAI was Tunisia. TAI made the first delivery to Tunisia, which made three ANKA UAV orders in 2021. In late November 2021, it was announced that the second customer of the ANKA UAV was Kazakhstan. It is expected that three UAVS with equipment to be supplied to Kazakhstan.³²

Apart from the products developed by Baykar and TAI, Karayel Tactical UAVs produced by Vestel Defence (named Lentatek from now on) were displayed at the Hungarian Pápa Bázisrepülőtér Base, being subjected to a series of tests. It is well-known that Hungarian authorities stated their interest in acquiring various Turkish-made drones, including Bayraktar TB2s and ANKAs, and they are closely monitoring the market for a potential supply.³³

Other than that, operationally used by the TAF since 2018, the KARGU Autonomous Tactical Multi-Rotor UAV developed by STM was successfully exported to a country in South America.³⁴

All these export records have not been as easy as taking candy from a baby. It is noteworthy to underline Turkey's allies' unwillingness to sell and the EU countries' agreement to limit arms and component exports to Turkey or problems that occurred in the outsourcing of the subsystems used in the production of those UAV systems. For example, Germany and Canada decided to impose an embargo on some military equipment and components due to Operation Peace Spring carried out by the TAF in the northeast of Syria in October 2019. While the German government has not shipped subsystems and equipment used in the construction of UAVs since 2019, Canada announced in June 2020 that it might grant export permits for Wescam's electro-optical and infrared camera systems. However, after the use of Bayraktar TB2s against Armenia by the Azerbaijani

31 Kamer Kurunç, "Polonya'nın Bayraktar TB2 Tedarikinde Yeni Detaylar", *Savunma SanayîST*, 7 July 2021, <https://www.savunmasanayist.com/polonyanin-bayraktar-tb2-tedarikinde-yeni-detaylar/>

32 "TUSAŞ'tan bir ülkeye daha ANKA ihracatı", *Savunma SanayîST*, 22 November 2021, <https://www.savunmasanayist.com/tusastan-bir-ulkeye-daha-anka-ihracati/>

33 Kamer Kurunç, "Vestel Üretimi KARAYEL SİHA Macaristanda Teste Girdi", *Savunma SanayîST*, 5 November 2021, <https://www.savunmasanayist.com/vestel-uretimi-karayel-siha-macaristanda-teste-girdi/>

34 "GÜLERYÜZ: "KARGU"yu Güney Amerika'ya İhraç Ettik", *Savunma SanayîST*, 15 March 2022, <https://www.savunmasanayist.com/guleryuz-karguyu-guney-amerikaya-ihrac-ettik/>

Armed Forces, Canada returned to the embargo decision.³⁵ At the NATO foreign ministers' meeting in Brussels, Foreign Minister Mevlüt Çavuşoğlu hinted that Canada is aiming to loosen the defence industry export ban, after the outbreak of the Ukrainian conflict.³⁶

Furthermore, some NGOs in Germany were uncomfortable using Argos II, target acquisition systems produced by Hensoldt company, by Turkey and the countries Turkey exported platforms to using these subsystems. In this regard, it is said that several organizations, including Greenpeace, are planning to pressure the Federal Government over the arms export control law. Hensoldt, whose main capital comes from an unknown fund in the U.S. and the German government, denied the allegations of non-compliance with export law but admitted that they had set up a subsidiary company in South Africa just for this reason.³⁷

Recipient	UAV Model	Supplier	Ordered	Year of Order	Delivered
 Azerbaijan	Bayraktar TB2	BAYKAR	5	2020	5
 Kazakhstan	Anka	TAI	3	2021	by 2023
 Kyrgyzstan	Bayraktar TB2	BAYKAR	3	2021	by 2022
 Libya GNC	Bayraktar TB2	BAYKAR	12	2019	12
 Morocco	Bayraktar TB2	BAYKAR	13	2021	6
 Poland	Bayraktar TB2	BAYKAR	24	2021	by 2024
 Qatar	Bayraktar TB2	BAYKAR	6	2018	6
 Saudi Arabia	Karayel	Vestel	46	2020	6
 Tunisia	Anka	TAI	6	2020	3*
 Turkmenistan	Bayraktar TB2	BAYKAR	3	2020	3
 Ukraine	Bayraktar TB2	BAYKAR	12+48*	2018+2020*	12+16**

Source: SIPRI *SavunmasanaylST
**Reuters

35 Ahmet Alemdar, "Türk İHA sistemlerine Almanya'dan alt sistem tedariki", *Defence Turk*, 25 August 2020, <https://www.defenceturk.net/turk-ih-sistemlerine-almanya-dan-alt-sistem-tedariki>; Ata Ahmet Kökçü, "Kanada, silah ambargosuna rağmen Türkiye'ye İHA optiklerinin satışını onayladı", *Defence Turk*, 18 June 2020, <https://www.defenceturk.net/kanada-silah-ambargosuna-ragmen-turkiye-ih-optiklerinin-satisini-onayladi>; Ahmet Bayar, "Kanada, Türkiye'ye yönelik ihracat izinlerini askıya aldı", *Defence Turk*, 5 October 2020, <https://www.defenceturk.net/kanada-turkiye-ye-yonelik-ihracat-izinlerini-askiya-aldi>

36 "UK lifts defense export ban on Turkey, Canada may be next: Çavuşoğlu", *Daily Sabah*, 8 April 2022, <https://www.dailysabah.com/business/defense/uk-lifts-defense-export-ban-on-turkey-canada-may-be-next-cavusoglu>

37 "Türkische Kampfdrohnen-Tod aus den Wolken - mit deutscher Technik?", *ZDF*, 20 November 2021, <https://www.zdf.de/nachrichten/politik/kampfdrohnen-tuerkei-hensoldt-100.html>

Turkey, committed to international humanitarian law, takes into consideration the risks that may be caused by the end user's aim to operationalize these systems, or the possible unintended and collateral results of a military task conducted by combat drones. Therefore, Turkish companies, as well, adopt a light touch and protect Turkey's delicate balancing and peace promoting attitude, while finalizing export agreements and authorizing arms exports.

Acknowledging that drone proliferation across military and civilian spheres is unavoidable, how do international export controls and regulations on both commercial and military UAVs impact industry trends?

Under these ambiguities, there is certainly a need for clear international export controls and regulations on both commercial and military UAVs, acknowledging that drone proliferation across military and civilian spheres is unavoidable. However, these regulations should not affect industry trends negatively. Mr. Felix Woessner underlines: *“The export regulations differ from the type of drone, the drone is either for commercial or military use. In some cases, drones can be used for both commercial and military purposes which is dual-use category.”* On the other hand, Mr. Samuel Bendett stresses the difficulties of imposing total control: *“Countries or entities that really want to acquire this technology can do so via illegal or ‘grey’ exports or use third parties for imports. The ‘grey’ area is an especially difficult area to police, given that platforms, components, weapons/munitions and/or and software solutions for military and commercial UAVs can be reclassified as civilian or military based on the final customer destination.”*

Besides providing operational flexibility to the TAF and projecting Turkey's military power in highly contested environments like in the Middle East, the Eastern Mediterranean and North Africa, Turkish-made drones also provided a number of political and economic opportunities and diplomatic benefits for Turkey.

Beside inserting Turkey's military power into the regional conflicts, how have Turkish drones served Ankara's geopolitical interests, provided opportunities and diplomatic benefits?

According to **Mr. Federico Borsari**, Leonardo Fellow at the Center for European Policy Analysis (CEPA) and NATO2030 Global Fellow, the assignment of Gecitkale Air Base in the TRNC for the use of UAV operations³⁸ *“have increased*

38 “Turkey deploys unmanned aerial vehicles to Turkish Cyprus”, *Hurriyet Daily News*, 15 December 2019, <https://www.hurriyetdailynews.com/turkey-deploys-unmanned-aerial-vehicles-to-turkish-cyprus-149867>

Turkey's deterrence and bargaining power vis-à-vis neighbouring countries in the contested Eastern Mediterranean waters, which remain the most strategic dossier of Turkish foreign policy. Politically, they have served as a soft power tool for cementing diplomatic relations and making new friendships after years of foreign policy isolation at the regional level."

Another expert **Mr. Ali Bakeer** from Ibn Khaldon Center at Qatar University, stresses that Turkish-made drones have been playing a critical and decisive role in realizing Turkey's position vis-a-vis its rivals both at the diplomatic level and on the field. He states that: *"Thanks to its UCAVs Turkey cannot be excluded or isolated when it comes to talks on the future of Libya or the Eastern Mediterranean. Similarly, Ankara's UCAVs prevented Assad, his backers, and the PKK affiliated groups from destabilizing the region. In the Caucasus, Ankara's drones have unlocked the potentials of the done-diplomacy with the aim of transforming the region politically and economically,"* underlining Turkey's key role in the ceasefire and eventual agreement in the Nagorno-Karabakh conflict.

Another region in which the Turkish-made drones brought about tangible outcomes for Turkey is Africa. **Mr. Bilgehan Ozturk**, a researcher at SETA Foundation, highlights that: *"Use of drones in Libya was power projection but at the same time it changed the military balance of power in the country and changed the political and international landscape surrounding Libya, not to mention the dynamics in the East Mediterranean. Moreover, Tunisia and Morocco became buyers of Turkish drones after Turkish move in Libya, and Algeria seriously mulled buying Turkish drones before choosing Chinese ones."* Reiterating that African countries were among the first to express their intention to order Turkish-made drones, **Mr. Ibrahim Bachir Abdoulaye** from the University of Bayreuth, argues that, *"The success of the UAVs has accelerated the process of exporting Turkish weapons and other military equipment and has strengthened defense cooperation with African countries."* Expressing that defense and security cooperation has been one of the main subjects of official visits between Turkish and African authorities, Mr. Abdoulaye gives some examples by stating: *"Last October, during his visit to Turkey, Nigeria's Minister of Industry, Trade and Investment, Richard Adeniyi Adebayo, said they were 'exploring the Turkish defense industry,' adding that they were in talks with the Turkish Defense Ministry. The Nigerian President's official visit to Turkey in early March was largely dominated by defense issues. Long before this visit, Niger had stated its willingness to buy drones, Hurkus training helicopters, and armored vehicles. In fact, President Ba-*

zoum Mohamed's visit to the Turkish defense industry was widely reported in the local Nigerian media."

The indigenously built Turkish drones' successes in Libya, Syria, Iraq, Nagorno-Karabakh, and recently Ukraine have a manifold affect on Turkey's defence exports. Acknowledging that more than 50% of Turkey's defence exports in 2021 were carried out by the aviation industry, evidently, Turkish-made drones have a significant share in Turkey's defence and aviation industry exports of over \$3 billion.³⁹ Mr. Anıl Sahin reemphasizes this situation: *"Today, Turkey has exported ANKA, Bayraktar TB2, AKINCI, and KARAYEL type UAVs to more than 20 countries. Although a significant part of these countries is not disclosed due to confidentiality, we know that there are important African countries among them. Through open sources, it has been confirmed that Tunisia (ANKA), and Morocco (Bayraktar TB2) have supplied Turkish UAVs. On the other hand, it is claimed that some African countries such as Angola and Nigeria also supplied Turkish UAVs. UAVs platforms have an important place in Turkey's defence export records. In addition, thanks to UAV platforms, the number of countries with which we have made military cooperation and Government-to-Government (G2G) agreements has increased considerably."*

How could indigenously built Turkish drones' successes in Libya, Syria, Iraq, Nagorno-Karabakh and recently Ukraine contribute Turkey's defence exports? Do you believe that Turkish drones are a strategic means for building a military cooperation model between Turkey and buyer countries?

As mentioned above, more importantly, Turkish drones have turned out to be strategic means for building a military cooperation model between Turkey and buyer countries, establishing a spill-over effect to spread the relations in political, social, and economic spheres, as well.

First of all, providing a cost-effective technology, the Turkish-made drones are easily accessible products, conducting advanced and complicated tasks as its equivalent technologies with higher prices, for many buyer countries. **Mr. Murat Aslan** from the SETA Foundation impresses on this by saying: *"The suppliers usually claim high prices and limitations in exploiting provided weapon systems. Per the supplier's interests, continuity of the arms flow may stop and could endanger the survivability of the consumer. In this sense, Turkey's arms delivery and military*

³⁹ Türkiye İhracatçılar Meclisi, "İhracat Rakamları", <https://tim.org.tr/ihracat-rakamlari>

mentorship provided a cost-effective solution to the needs of the consumers and the TAF. As a platform to varying sorts of combat and combat support systems, Turkish UAVs facilitated access to complicated weapon systems within the limits of the budgets.” Therefore, Turkish-made drones attracted consumers due to bolstering sustainable relations at the strategic level.

Secondly, the long-term partnerships with Ukraine and Azerbaijan proved that Turkey may establish similar cooperation models with the countries, particularly those sharing cultural ties with Turkey. Mr. Agil Rustamzade draws attention to prospective opportunities for Turkish products in the Turkic world. According to Mr. Rustamzade: *“Many countries wanted to buy such an effective weapon, especially given its ability to destroy Russian air defense systems. Sustainability of efficient training and operation of such complex systems as strike drones are possible only with establishing long-term military cooperation between the buyer countries and Turkey. Turkish strike drones have become the most demanded product in many countries, including the states of the Turkic world. Defense cooperation is already carried out in various areas with Azerbaijan. Also implemented and concluded new contracts with Turkmenistan. There are good prospects for defense cooperation with Kazakhstan, Uzbekistan, and Kyrgyzstan.”*

Thirdly, the prospering partnerships and the efficient performance of Turkish-made drones against the Russian-made military products in Libya, Nagorno-Karabakh, and recently in Ukraine may serve as a vivid advertisement for Turkey’s growing defence industry since there is no better advertisement than the “combat-proven” mark. Mr. Ali Bakeer expresses: *“The Turkey-Qatar defense and military partnership surpassed the traditional relation between the seller and the client. Qatar now is a partner in several strategic defense projects in Turkey. Doha is investing in Turkey’s defense sector not only to meet its rising needs of defense equipment, but also to be part of the success story and benefit in the long run. This kind of partnership has a transformational effect on the relationship between the two countries and cement the alliance between them. Several other Middle Eastern countries aspire the same model in different degrees.”*

Similarly, Mr. Bilgehan Ozturk addresses the partnership with Ukraine as a benchmark for similar partnerships stating that: *“Turkish drones can be a strategic means for a military cooperation between Turkey and buyer countries, if they go beyond purchase only. Turkish-Ukrainian cooperation is a good example. Bilateral cooperation has not been limited to purchase but went beyond that and saw construction of drone factory in Ukraine and even joint production. The same can be*

repeated with certain African countries, too.” Mr. Ibrahim Bachir Abdoulaye adds that: “This is evidenced by the growing numbers of defense cooperation agreements signed between Ankara and several other African countries, such as Somalia, Sudan, Chad, Mauritania, Guinea, Nigeria, Benin, Gambia and Niger etc.”

Mr. Federico Borsari discusses the case of Ukraine as such: “Turkey has cleverly sensed the skyrocketing trajectory of UAV market and exploited the geopolitical and economic benefits emanating from its domestically produced UAVs. Selling drones often entails the establishment of long-term security partnerships that revolve around the provision of after-sale assistance, spare parts, and training support. In the case of Ukraine, partnership with Baykar foresees both a domestic production line for Ukrainian TB2s and the use of Ukrainian-made engines for Baykar’s next-generation drones. Despite the potential delay caused by the Russian invasion, this partnership may become a benchmark for similar initiatives between Turkey and other nations, including the EU countries, that could combine Turkish know-how in unmanned technology and EU’s technological capabilities for specific components.”

Lastly, other than their technological features, what makes Turkish-made drones an efficient military asset is the concept of operation (CONOPS) that Turkey has used. Turkey has not only supplied its technology but also the TAF’s CONOPS to the buyer countries, as well. **Mr. Mauro Gilli**, Senior Researcher in Military Technology and International Security at the Center for Security Studies of ETH-Zurich, remarks that: “One aspect that the media has paid comparatively little attention to, but those buyers are probably very aware, is the concepts of operation (or call it, the tactics) that Turkey has used to make its drones effective. MALE drones are vulnerable to air defense systems, so to use them effectively against enemies that are more capable than terrorist or insurgent groups, a set of complementary technologies (such as electronic warfare systems and decoys) and coordinated tasks are necessary. Some countries might want to buy not only Turkish technology, but the whole package – that is, Turkish experience with employing effectively drones in recent conflicts as well as the complementary technologies.”

While Turkish drone manufacturing companies are striving to capitalize on the market, can production of swarming intelligence systems and novel developments make Turkey’s entrance into the top technology league possible?

Another aspect that should be underlined is loitering munitions such as the KARGU Autonomous Tactical Multi-Rotor UAV, the ALPAGU Autonomous Tactical Fixed-Wing UAV, and the TOGAN Autonomous Multi-Rotor UAV devel-

oped by STM and the project MIUS (or Bayraktar Kizilelma) jet-powered *combat unmanned aircraft system* and Bayraktar TB3 MALE UCAV capable of short-range landing and take-off developed by Baykar that may enable Turkey to enter to the top technology league.

Let's focus briefly on MIUS, which planned to carry out the first flight test of the Bayraktar Kizilelma in 2023. The project MIUS is a future unmanned warfare concept.⁴⁰ While Kizilelma-A will be powered by an AI-25TLT engine, the Kizilelma-B variant will be powered by an AI-322F engine produced by Ivchenko-Progress. Capable of operating in highly contested environments with low RCS, high maneuverability, and situational awareness with AESA radar, featured with LOS and BLOS communications and fully automatic takeoff and landing, capable of taking off and landing on short runway aircraft carriers Bayraktar Kizilelma will perform highly challenging air-to-air combat tasks and overseas missions.⁴¹ The first prototype already entered the production line in March 2022.⁴²

Mr. Ali Bakeer believes that: *“As a drone power, Turkey is one of the top producers of this kind of technology. For some time, it was thought that China's drones are serious competitors, yet this is not what it turned to be. With Ankara's new futuristic systems such as the swarming intelligence systems, MIUS jet-powered UAV, and TB3, Turkey will be playing in a very different league.”* Mr. Bilgehan Ozturk, on the other hand, warns that the competition in the African defence market will be a fierce one, adding that: *“Increased capacity in both swarm and MIUS and TB3 would definitely position Turkey in the top defence technology league in the world. Based on experience in Algeria, China is already a competitor for Turkey in the African defence market. Algeria finally chose Chinese drones over Turkish ones. Apart from that, Russian systems are very widespread in African countries.”* Mr. Ibrahim Bachir Abdoulaye is in line with Mr. Ozturk, pointing out that: *“Turkey's main competitors in the drone market are China and Israel, which have a significant share of the market. But the advantages offered by Turkey's defense industry could eventually place Turkey at the top of the list of drone-supplying countries on the African continent. In addition to the security challenges facing African countries, the war unleashed by Russia in Ukraine is likely to push some of these countries to further*

40 “Bayraktar KIZILELMA (MİUS)'nın Üretimi Başladı”, *Savunma SanayîST*, 12 March 2022, <https://www.savunmasanayist.com/bayraktar-kizilelma-miusnin-uretimi-basladi/>

41 Baykar, “Fighter UAV”, <https://baykartech.com/en/fighter-uav/>

42 “Baykar's unmanned combat aerial vehicle enters production line”, *TRT World*, 12 March 2022, <https://www.trtworld.com/turkey/baykar-s-unmanned-combat-aerial-vehicle-enters-production-line-55468>

increase their military spending. Turkey can seize this opportunity to become one of the continent's major arms suppliers in the long term."

Mr. Anil Sahin, on the other hand, underlines the possibility to export the advanced and futuristic platforms such as MIUS and TB3 to highly developed countries by arguing that: *"Since the number of unmanned platforms in this class that can take off and land on an aircraft carrier in the market does not exceed the fingers of a hand and developing such systems requires very high R&D investments, not every country is able to develop these systems and so they are prone to off-the-shelf procurement."* Regarding the competition in the market circulating between the U.S., Israel and China, Mr. Sahin criticizes that: *"The U.S.-made UAV platforms contain advanced technologies, but they are very expensive, and the U.S. export policy is very strict, so only a few countries in the Gulf, which are rich strategic partners of the U.S. are able to procure the U.S.-made UAVs. Israel's UAV platforms are also highly developed and having high demand, especially from the Asian region. However, they are generally used for ISR missions. Lastly, China has a highly developed UAV product portfolio. Cheap Chinese products were exported to many countries, including Africa. However, they have serious problems with quality of technology."* Mr. Mauro Gilli also foresees an opportunity in the drone market for Turkish-made drones as such: *"Turkey will keep competing in the MALE drones, where the most important producers are the U.S., Israel, and China. The arms industry, by definition, is very political in the sense that weapons acquisition also follows alliances and other political considerations. Turkey might be able to enter the market of countries that do not want Chinese technology, and do not want to go through the restrictions or other limitations imposed by American technology."*

Recently, Airbus and the Organisation for Joint Armament Co-operation (OCCAR) have signed the Eurodrone project. Do you expect further European collaboration on drone development and manufacturing programs? Do you think the Eurodrone project will guarantee the strategic autonomy of Europe by offering new alternatives to the off-the-shelf acquisition of non-European products, like Turkish-made drones?

Not only in the Middle East, Africa, or Asian markets but also the European market, there is room for Turkish-made products, as Poland's acquisition proves. Over the years, European countries have struggled to collaborate on European drone development and manufacturing programs. Recently, Airbus and the Organisation for Joint Armament Co-operation (OCCAR) signed the Eurodrone

project.⁴³ Whether the project will guarantee the strategic autonomy of Europe by offering new alternatives to the off-the-shelf acquisition of non-European products or not is not clear for now. Especially after the Ukrainian conflict, for states feeling threatened by the Russian aggression, the Turkish-made drones may be an alternative, reliable solution. Again, the novel technologies such as the Bayraktar Kizilelma and Bayraktar TB3 may be a gap filler for the European countries that do not invest in joint industrial projects or do not have a sufficient budget for expensive Israeli and American products. Mr. Federico Borsari elaborates: *“A deeper Turkey-EU cooperation on UAVs remains remote since both actors are currently pursuing different policies towards this technology, with EU countries lagging behind in terms of deployable capabilities as well as operational concepts. The Eurodrone represents a long-term objective, and in the short to-medium term many EU countries will still depend on US and Israeli systems. Poland, for instance, has just speeded up the process for the acquisition of MQ-9 Reapers UAVs from Washington after Russia’s aggression against Ukraine. Against this backdrop, Turkey’s role in the EU drone market will likely remain significant, with TB2s providing cheap but reliable solutions for small-size states such as Kosovo, and next generation UAVs such as the Akinci and MIUS whetting the appetite of bigger EU countries such as Poland or the Baltic states, which may use them to bridge specific capabilities’ gaps.”*

Another expert Mr. Mauro Gilli perceives the Russian aggression as a precipitating cause for the European industrial initiatives but also stated that these are not immune from challenges by saying: *“As a reaction to the invasion of Ukraine by Russia, several countries in Europe, including Germany and Italy, have stated they will increase their defense spendings. There is reason to believe that they will pursue joint European projects in many realms, drones included, to benefit from economies of scale and investments. Whether this approach will succeed remains to be seen, and past experience suggest caution. Economies of scale are not by themselves sufficient for ensuring success in advanced technologies, and often there are opposite incentives at play. For example, some of the companies involved might not want to share some of their technologies with their European competitors.”*

43 Airbus, “Airbus and OCCAR sign Eurodrone contract”, <https://www.airbus.com/en/newsroom/press-releases/2022-02-airbus-and-occar-sign-eurodrone-contract>

CONCLUSION

The emerging unmanned military platforms, smart systems and munitions manufactured by Turkey have become popular in the international defence market. It was Turkish-made drones with their modern features that proved the advanced air defence systems archaic in Libya, Idlib, Nagorno-Karabakh, and lately in Ukraine. Arising from the Turkish-made drones' overwhelming combat performance, the demand for those platforms has multiplied rapidly, resulting in a manifold effect on Turkey's defence exports.

Besides projecting Turkey's military power by increasing its deterrence and bargaining power, they have served as a soft power tool for cementing diplomatic relations, as well. But more importantly, they have turned out to be a strategic means for building a military cooperation model between Turkey and its recipients. Furthermore, considering the possibility of exporting advanced and futuristic platforms to developed countries, Turkey may seize the opportunity to become one of the major suppliers in the long term.

UNPACKING THE DEBATE ON TURKISH DRONES

SİBEL DÜZ

The emerging unmanned military platforms, smart systems and munitions manufactured by Turkey have become popular in the international defence market. It was Turkish-made drones with their modern features that proved the advanced air defence systems archaic in Libya, Idlib, Nagorno-Karabakh, and lately in Ukraine. Arising from the Turkish-made drones' overwhelming combat performance, the demand for those platforms has multiplied rapidly, resulting in a manifold effect on Turkey's defence exports.

Besides projecting Turkey's military power by increasing its deterrence and bargaining power, they have served as a soft power tool for cementing diplomatic relations, as well. But more importantly, they have turned out to be a strategic means for building a military cooperation model between Turkey and its recipients. Furthermore, considering the possibility of exporting advanced and futuristic platforms to developed countries, Turkey may seize the opportunity to become one of the major suppliers in the long term.