Total Number of Defence related UAV compression in the Middle East: Turkish Security Forces

Ömer Levent Durdalı
Bilkent University
Dept. of Computer Technology and Information Systems
Ankara, Turkey
levent07@protonmail.ch

***Abstract*— Drones have become standard military equipment. Battlefields in Ukraine, Syria, Iraq, and Libya, are increasingly crowded with drones of varying size and sophistication. They are used for intelligence gathering and aerial strikes, drones are a leading contributor to the changing characteristics of modern war. In this newly defined war concept, Turkey a fairly new drone power will be studied in terms of general drone production and compared with existing drone powers.**

Keywords—*UAV, Turkey`s UAV, UAV Number Comparison, UAV Production*

I. INTRODUCTION

While the U.S was the foremost operator of armed, unmanned aerial vehicles (UAVs) in the world for more than a decade, launching the first drone attack in 2001[1], today more than a dozen countries possess this technology. The U.K., Israel, France, Germany, Pakistan, Saudi Arabia, the UAE, Egypt, Nigeria, and Turkey have all used armed UAV's to kill targets since 2015.[2]

Turkey stands out as not only the most advanced new developer of drones but also as the only country to regularly use them on its own soil.[2]

This study will visualize Turkey`s ongoing defence-related drone projects and their overall numbers. Therefore, this study will compare additional nations and their drone armies, this will mainly consist of neighbouring or Middle Eastern and North African (MENA) countries. Which are Israel, Egypt, Greece, Iran, United Arab Emirates and the United Kingdom, U.K. has been chosen because it is the most prominent UAV user in Europe and is an active UAV user in the Mediterranean Sea.[3]-[5]

The terms "unmanned aerial vehicle," or "UAV," and "drone" are used interchangeably in this study.

II. STUDY AREA, DATA AND METHODOLOGY

Primary sources cited are official government statements and records, photographs and videos, social media, geospatial imagery, and technical data.

Secondary sources include books, newspaper and journal articles, and research papers. Multilingual search methods were used to access certain primary and secondary sources. Free, public databases of military equipment exports, such as that of the Stockholm International Peace Research Institute.

Different governments have different degrees of transparency as such research into drones can be challenging. Sources may be conflicting, out-of-date, or may have partial information. While all data and statistics can be verified it may not be entirely true. So, this study only considers verifiable data.

This study only accounts for Class III Fixed Wing drones. This classification is from NATO STANAG 4670 —NATO's guidance for training drone operators [6]— Which classifies drones from their maximum take-off weight in this case, Class III, more than 600 kilograms.

Class III UAVs are either referred to as "medium-altitude long-endurance" (MALE) or "high-altitude long-endurance" (HALE) UAVs. A typical Class III system has an endurance of up to 24 hours or more, a payload capacity of several hundred kilograms because of this aside from NATO standards all UAVs that fulfil these criteria have been counted.

The NATO definition of Class III includes three sub-categories, MALE, HALE, and Combat. For simplicity this study combines these categories.

III. TURKEY`S DRONE AGE

Since 1975, when the U.S imposed sanctions, after Turkey's invasion of Cyprus, Turkey had sought to develop its defence industry. This led to all sorts of programs were started to minimize their bonds to the U.S. Some of those projects were to develop Unmanned Aerial Vehicls. These projects eventually lead to TAI's [7] Anka, Aksungur, Şimşek, Turna. Baykar Makina's [8] Bayraktar, Akıncı. Vestel's [9] Karayel. STM's [10] Kargu, Aplagu, TOGAN.

While Turkey has many drone projects only a couple of them are regarded as Class III, which are Anka, Karayel, Akıncı, Bayraktar and Aksungur as such these are the only drones that will be counted.

Turkey stands out as not only the most advanced new developer of drones but also as the only country to regularly use them on its soil.[11] while also deploying drones for operations in northern Syria and Iraq.[12],[13],[14] Turkey has made extensive use of Bayraktar and Anka drones for surveillance and strikes in its military operations and has claimed that its Bayraktar-TB2s alone completed 382 sorties in the operations in Syria[15] and have lost Several Bayraktar-TB2s in the process.[16]

Turkey`s fist drone was purchased from the U.S in 2007 and a couple more trough 2007-2014 but in the end Turkish security bodies were not satisfied[17], So Turkey began searching a domestic alternative , private or government companies, in the end , in 2016 two different companies came up with two different drone solutions[7],[8] which were bought by Turkish security forces. Ever since 2017 Turkey has increased its drone production while stopping all Class III purchases.

Turkey`s Yearly UAV Production (2017-2019)

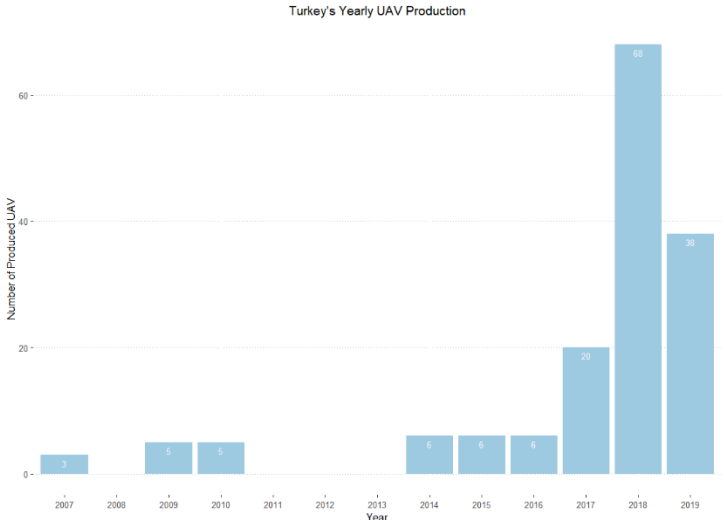

Figure 1: Turkey`s Yearly UAV Production

Figure 1 shows the basic yearly production values for Turkey. After the completion of various domestic UAV projects, Turkey has rapidly started to produce more UAVs for Internal and external operations. The result can be seen in the year 2017. When factoring Figure 1 and 2 together one can easily see that 2013 could be regarded as the start date for domestic products. Because when you factor in the production time and the delivery to security forces –generally they take one year to test– So that is why there is an increase of drones in 2014

Turkey`s Cumulative Total Number of UAVs (2007-2019)

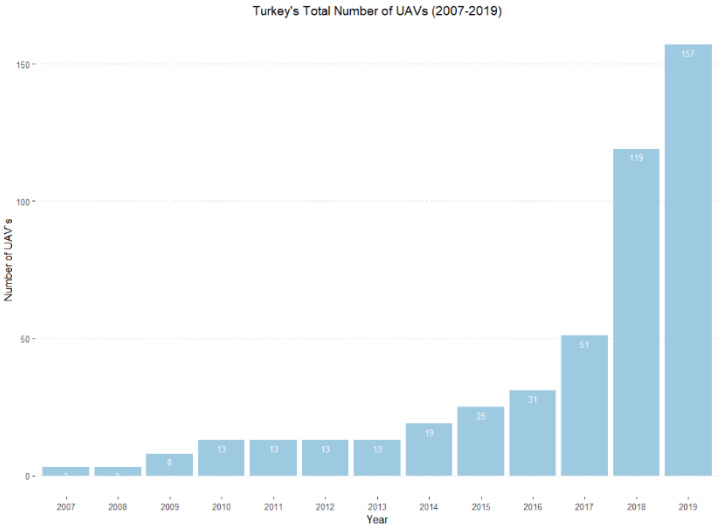

Figure 2: Turkey`s Cumulative Total Number of UAVs (2007-2019)

Turkey is growing its UAV arsenal very rapidly as in just two years between 2017-2019 over 100 UAVs has been produced and is being used by the security forces. This is the reason for the high positive numbers in the skewness from the statistics Table. In just under a year in 2018, Turkey became a UAV power outclassed only by the major UAV operator and producers like the US, China, Russia, Iran and Israel. This can be easily seen in Figure 2 and Figure 3 respectively. The major increase in production in 2018 and 2019 causes the highly positive kurtosis as well.

Top 5 UAV Users and Turkey (2019)

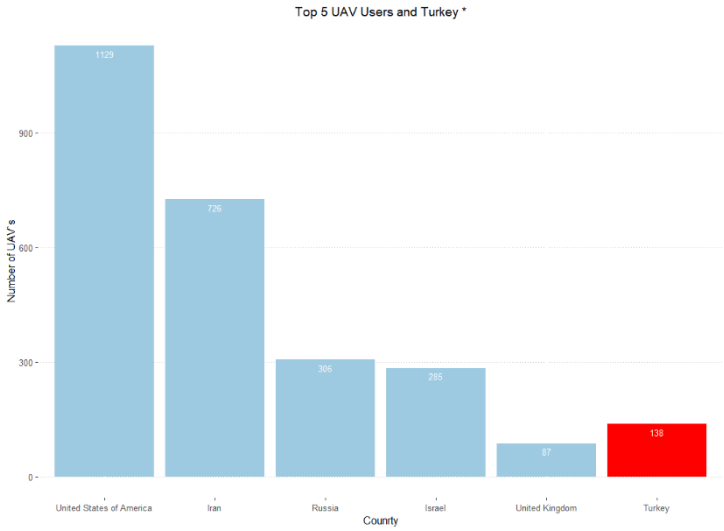

Figure 3: Top 5 UAV Users and Turkey 2019 (excluding China[1])

As seen by Figure 3 Turkey has become the 5Th and if we include China it has become the 6Th drone user in terms of quantity. While these graphics only give an example of Class III drones. Turkey is also a capable Class I and II drone producer. Additionally, if Class I and II drones are counted, Turkey won't lose its position as a country in the top five.

A. Country Comparison by Drone Numbers

The following chapter will compare the overall number of drones in 2019 for these countries; Israel, Egypt, Greece, Iran, United Arab Emirates and The United Kingdom.

Total Number of UAVs by Country

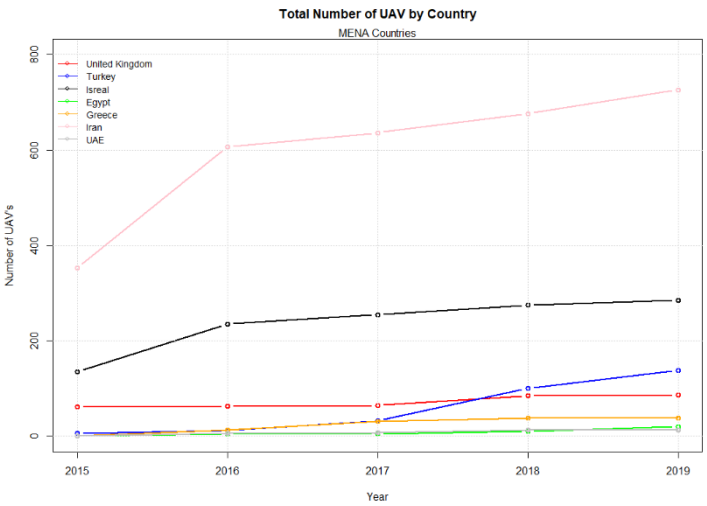

Figure 5: Total Number of UAVs by Country

UAV operators, Iran, Israel and Tukey are all capable of producing UAVs domestically. Iran (Pink) shown

1.China`s drone programs are regarded as a state secret, other than the ones they export no numbers have been found.

in Figure 5 has the largest drone arsenal in MENA. Iran's drone program started in the '80s and had two major advancements in its drone history one in the '90s and the other in 2011. After Iran shot down a U.S drone in 2011[18] Iran's drone development sped up significantly as they had reverse-engineered [18] the downed drone and ever since, their drone capabilities and production has significantly increased. This event can be seen as the major increase in Iran's drones in the years 2015-2016 as their copy of the downed U.S drone made its debut.[18]

A similar event can be seen for Turkey as well, Turkey first bought its drones from the U.S and Israel and has been buying drones [19] from 2007-2014 while learning the capabilities and figuring out the downsides of the bought systems.

After learning all the necessary aspects which are needed and finding the aspects that should be improved. Turkey sped up its drone programs. Since than Turkey has started to mass-produce its drones in hopes of using them for its security, military operations and also for exporting. This led to the major increase seen in figure 5 (Blue Line) in the years 2017-2018.

Total Number of UAV`s by Country (2019)

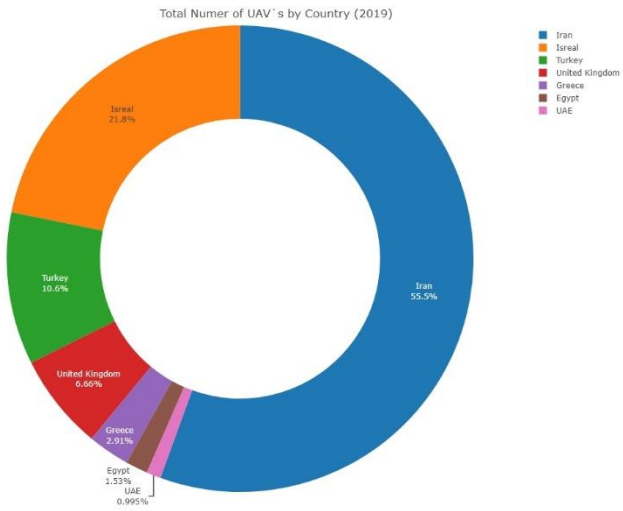

Figure 6: Total Number of UAVs by Country

As a final note the countries overall percentage is show in Figure 6. Just two countries alone make up more %75 of the UAV numbers which are Iran and Israel. While Turkey with its rapid production can't pass over %10.

B. The Future of Turkey`s Drone Age

FUTURE OF TURKEY`S YEARLY UAV PRODUCTION

YEAR	2016	2017	2018	2019	2020
NUMBER	6	20	68	38	45

Table 1: Future of Turkey`s Yearly Production

This table shows the production numbers in the given years. The general consensus among industry experts are, after all major UAV projects have been completed and have been tested by the Turkish Security Forces, the companies started to develop and produce more complex UAVs. This led to the drop of quantity in UAVs but achieving the same goals with even more capability. As such the production for 2021 is expected to drop and is assumed to stay at higher than in 2017 and lower than in 2019.

a. Future of Turkey`s Drone Projects

- The Akıncı, a Class III fixed-wing UAV developed by Baykar Makina.[20] It will be Turkey's heaviest unmanned aircraft. Its flight tests began in November 2019 [20], with production stated to begin in 2020 and deliveries commencing in 2020 or 2021.

- The Anka-Aksungur, also known as the Anka-2, is a Class III fixed-wing UAV developed by Turkish Aerospace Industries. Conducted its first flight in March 2019. [21] According to TAI, the Anka-Aksungur will have a payload of over 700 kilograms, more than three times that of the Anka. Its flight tests began in 2019

- MIUS, Unmanned Fighter Jet Project, Baykar Makina the company that is producing and developing Bayraktar and Akıncı has stated that before 2024[22] Baykar Makina`s MUIS project will be completed. While not much is known about it, it is expected to be a very cable system.

With these advanced projects Turkey is expected to be a more dominate drone power. Begin even more capable than it was before.

IV. Results and Conclusion

As seen in Table 2 during the study, UAV numbers were analysed with the available data (NAD) identifying maximum values (Max), 95\% percentile (95\%), 75\% percentile (75\%), 25\% percentile (25\%), 5\% percentile (5\%), minimum values (Min), standard deviation (Std), coefficient of skewness (Skew) and the coefficient of kurtosis (Kur). The results indicate that Turkey and the United Kingdom has a positive skew while all the others are fairly symmetrical. Which means that Turkey and the United Kingdom have been highly active in terms of UAV production or procurement. Again, except for Turkey and the United Kingdom, all countries have a Platykurtic (Kur < 3) meaning that data are light-tailed or lack of outliers while Turkey and the United Kingdom are Leptokurtic (Kur > 3) meaning that data are heavy-tailed or has outliers. Once ageing showing the erratic production or procurement of drones by Turkey and the United Kingdom.

While this study doesn't necessarily cover all countries that use drones, I believe that some small information should be given. Another 30 countries are believed to have acquired or are in the process of acquiring drones [23]. From these 40 countries, at least 24 of them are currently developing new military unmanned aircraft [24]. These countries collectively have 36 Class III drone projects and at least seven countries are exploring potential designs for next-generation drones which in theory will need a new classification.

This study clearly shows Turkey`s ambitious drone journey has started very recently but has developed drastically in such a short time frame. Therefore, Turkey

UAV Numbers	Descriptive statistics										
	NAD	**Max**	**95%**	**75%**	**Average**	**25%**	**5%**	**Min**	**Std**	**Skew**	**Kur**
Turkey	14	68	62	38	12.1	6	6	0	19.09	2.03	5.21
United Kingdom	6	62	53.6	20	17.4	2	1.2	1	21.37	1.32	3.41
Israel	5	135	128	100	57	20	12	10	50.75	0.53	-2.09
Egypt	5	10	9	5	4	0	0	0	3.74	0.34	-0.61
Greece	5	18	16.8	12	7.6	1	0.2	0	6.77	0.31	-1.41
Iran	5	353	333	253	145.2	40	32	30	132.82	0.57	-1.88
UAE	5	5	5	5	2.6	1	0.2	0	2.06	0.13	-2.72
Average	6.43	93	86.77	61.86	35.13	10.00	7.37	5.86	33.80	0.75	-0.01

Table 2: Descriptive statistical UAV numbers from *selected countries*.

stands as a country that has showed the potential of a newly emerging and developing counrty.

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