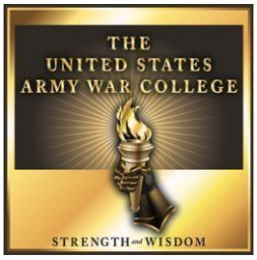
Strategy Research Project
International Fellow

Greece-Turkey Unmanned Aerial Vehicles: Challenges for Hellenic National Security

by

Lieutenant Colonel Nestoras Vargemezis
Greece Army

Under the Direction of:
Dr. Craig Nation



United States Army War College
Class of 2017

REPORT DOCUMENTATION PAGE

Form Approved--OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From - To)*
01-04-2017	STRATEGY RESEARCH PROJECT	

4. TITLE AND SUBTITLE
Greece-Turkey Unmanned Aerial Vehicles: Challenges for Hellenic National Security

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Lieutenant Colonel Nestoras Vargemezis
Greece Army

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Dr. Craig Nation

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army War College, 122 Forbes Avenue, Carlisle, PA 17013

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT Distribution A: Approved for Public Release. Distribution is Unlimited.
To the best of my knowledge this SRP accurately depicts USG and/or DoD policy & contains no classified information or aggregation of information that poses an operations security risk. **Author:** Y **PA:** y

13. SUPPLEMENTARY NOTES
Word Count: 6,527

14. ABSTRACT

Greece and Turkey share a long history over the centuries. As the followers of the Byzantine and Ottoman Empires their relationship is characterized by tension and conflict. As a result the build-up of military capabilities is very important for both countries. Since the current President Recep Tayyip Erdoğan came to power, Turkey has increased significantly its investment in the military with the goal to become totally independent from international suppliers and produce its equipment domestically. One of the major goals of this project was the production of indigenous UAVs with advanced capabilities and the program has already paid off with the production of vehicles capable of launching anti tank missiles. Greece on the other hand, although it has a long history in the research, development and use of UAVs, has not made significant steps to achieve similar goals. This paper will argue the reasons for the Turkish success, the implications for Greece's security and will recommend how Greece should move forward to build its own capacity and advance in the research for similar systems.

15. SUBJECT TERMS
UAS, Drones, South East Mediterranean, Aegean

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			**19b. TELEPHONE NUMBER** *(w/ area code)*
UU	UU	UU	UU	31	

Greece-Turkey Unmanned Aerial Vehicles: Challenges for Hellenic National Security

(6,527 words)

Abstract

Greece and Turkey share a long history over the centuries. As the followers of the Byzantine and Ottoman Empires their relationship is characterized by tension and conflict. As a result the build-up of military capabilities is very important for both countries. Since the current President Recep Tayyip Erdoğan came to power, Turkey has increased significantly its investment in the military with the goal to become totally independent from international suppliers and produce its equipment domestically. One of the major goals of this project was the production of indigenous UAVs with advanced capabilities and the program has already paid off with the production of vehicles capable of launching anti tank missiles. Greece on the other hand, although it has a long history in the research, development and use of UAVs, has not made significant steps to achieve similar goals. This paper will argue the reasons for the Turkish success, the implications for Greece's security and will recommend how Greece should move forward to build its own capacity and advance in the research for similar systems.

Greece-Turkey Unmanned Aerial Vehicles: Challenges for Hellenic National Security

Greece is a country with a millennial history. Located geographically in the crossroad of three continents and different civilizations, it has faced numerous invasions and wars throughout the centuries. In the modern era, Greece's history has been inextricably linked to the Ottoman Empire and its successor; Turkey. After years of conflict and the fall of the Byzantine Empire in 1453 AD, Greece suffered the occupation of the Ottoman Empire for almost four centuries until the successful revolution of 1821. Through long struggling efforts, the Balkan wars, and World War II, Greece obtained its current borders with the final addition of the Dodecanese from Italy in 1947. Since then the relations between the two countries have been in a constant turmoil because of the revisionist policy that Turkey applies in a number of issues such as the dispute for several Greek islands in the Aegean Sea and the jurisdiction of the Athens Flight Information Region (FIR). Almost on a daily basis Turkey violates the Hellenic airspace and territorial waters increasing deliberately the tension in the region. In contradiction with the international law of the sea (United Nations Convention on the Law of the Sea - UNCLOS), the Turkish National Assembly in 1995 ruled that the potential extension of the Hellenic territorial waters from six to twelve nautical miles would be perceived as an act of war (casus belli).[1] The tension peaked in 1996 when Turkish commandos temporarily occupied a Greek rocky islet in the Aegean and open hostilities were narrowly avoided. Since then the situation has remained tense and Turkey continues to raise issues about claims in the Aegean Sea and lately in Western Thrace. These claims have recently been stated in the most official way in several speeches of the Turkish President Recep Tayyip Erdoğan, where he has challenged the Lausanne

Treaty of 1923 that defined the existing borders of Greece with the modern Turkish Republic.[2] Turkey also in the last decades has been investing heavily in creating a robust indigenous defense industry resulting in the production of advanced tanks, helicopters, missiles and other high technology weapons systems such as satellites and Unmanned Aerial Vehicles/ Unmanned Aerial Combat Vehicles (UAV/UCAVs).

Under these circumstances, Greece has to be able to address any Turkish aggression, and tackle potential threats by maintaining well-equipped armed forces with increased defense capabilities. In the current economic austerity environment, a constantly decreasing defense budget is limiting the ability to purchase the numbers of new equipment needed, especially on the international market. As a result, Greece should seek to advance its military capabilities by investing in its domestic defense industry, focusing in new technologies that will provide quality equipment capable of balancing the quantity shortfalls. In this context, this paper will argue that an area that Greece should focus on is the development and construction of indigenous UAVs/UCAVs that will provide advanced capabilities in an already tested field, and counter the Turkish advances.

UAV and Drone Technologies - Global Trends and Prospects

The use of UAVs or drones is mentioned for the first time on August 22, 1849, when the Austrians, who controlled much of Italy at that time, launched some 200 pilotless balloons against the city of Venice, armed with bombs controlled by timed fuses.[3] Many decades later, in 1917, Elmer Sperry produced for the U.S. Navy the first unmanned plane designed to be a "flying bomb".[4] The evolution continued with the production of Charles Kettering's "Bug", another effort for a guided bomb, but the end of World War I limited the interest for that kind of weapons.[5] The next step was made by

the British. The need for an aerial target for anti-aircraft gunnery practice was fulfilled by the construction of Queen Bee, a new target aircraft based on John Hammonds' radio control system.[6]

For the next few years and during the largest part of World War II, the production of several remote piloted aircraft (RPA) was limited to flying targets. In the final years of the war, and after a costly daytime bombing raid in Schweinfurt, Germany, the U.S. Army Air Force and Navy tried to find an alternative to reduce the casualties of airmen. They experimented in remotely controlling B-17 and B-24 bombers from a trailing aircraft but there was no significant success.[7] Despite the failure of this project, the advances in technology and the advent of electronic digital computers, gave a new boost to the use of RPA's after the end of the war and during the Cold War era. The need for intelligence collection in the operations area or over a foreign nation resulted in a gradual transformation of the RPA's from flying targets or bombs to reconnaissance vehicles. Their first operational use for reconnaissance was during the Vietnam War where the U.S.-made "Lightning Bugs" flew numerous missions.[8] At the same time other countries also developed similar platforms. The Soviets developed the Lavochkin La-17 with hi-resolution cameras and videos. The Chinese, who in the first place benefited from Soviet technology, later reverse-engineered the La-17 as well as a recovered American “Lightning Bug” from North Vietnam and produced the Wu Zhen-5.[9] Israel in 1978 (benefitting from imported U.S. reconnaissance drone technology), produced its own drone, the Mastiff Mk 1. An upgraded model was used during the 1982 Israeli invasion of Lebanon as a decoy to activate the Syrian Soviet-made anti-aircraft missile batteries, which led to their total destruction.[10] This platform was brought to the U.S.

and developed into the Pioneer UAV that was used in Iraq in Operation Desert Storm in 1991 by the U.S. Navy providing targets for the battleships. From then on the evolution was very rapid. New platforms were created providing near-real time video like the GNAT 750 that was used in Kosovo for covert surveillance for the CIA.[11] At the same time a major breakthrough was made with the Predator.

The ability to track with persistence targets throughout the battlespace, like no manned aircraft could do, and using its laser to designate the target for strikes with guided munitions, led to the next logical step· the weaponizing of the UAVs. The first test with live munitions took place in 2001 and by the end of the same year the first strike was a reality against Al Qaeda terrorists in Afghanistan.[12] Since then, drones have been used for strikes in numbers that grow rapidly. They were used in combat zones in Iraq, Afghanistan, and Libya to eliminate military targets, and in non-combat zones in Somalia, Pakistan and Yemen for covert operations under CIA purview.[13] They were the means of “signature strikes” for U.S. *modus operandi*[14] intelligence and counter-guerilla warfare operations in killing insurgents without the need for “boots on the ground”. Although there is a great dispute about the legal and moral issues of these strikes, especially with the inevitable "collateral damages", the accepted premise is that they will continue in the future.[15] The use of drones for military operations in general, is not only going to continue but it is going to grow. Despite the economic issues that the U.S. is facing with the debt crisis burden and the possible reduction of the budget of the DoD, the funding for drone research and acquisition has increased. Former Secretary of Defense Leon Panetta emphasized this effort in 2013, when he prioritized the

development and deployment of UAV and UCAV technology over the conventional needs of the troops and other weapon systems.[16]

The U.S. is not the only country that is using drones or investing in that technology. All the major powers including Russia, China, France, the U.K. and others such as Israel and India are among the nations that have already acquired the technology. The U.K. and Israel are the two nations that have also used armed drones in combat.[17] Recently, drones were used as weapons in the conflict in Nagorno-Karabakh, where Azerbaijani Israeli-made Harop/Harpy 2 loitering munitions attacked Armenian targets.[18]

The significantly lower cost of drones over manned aircraft, the capabilities that they offer, and the protection they provide to military personnel, have made them attractive and today there is a great effort globally for their development. A study in 2011 estimated that 680 programs for drones were under development from various stakeholders all over the world.[19] The proliferation of technology has made it easier to build a drone even for private use and their use is expanding for multiple purposes that include businesses, e.g., overhead inspections of electric power transmission lines and pipelines, and domestic security and surveillance. The U.S. Congress has already investigated whether in the future a significant portion of the manned aircraft fleet will be replaced with unmanned aircraft.[20] That includes even the very large strategic bombers where the U.S. Air Force is already planning to utilize an unmanned new generation bomber.[21]

The future trend for the drones is that they will be more, or even fully, autonomous, and their operation will be based on artificial intelligence. They will be able

to take-off and land by themselves and even identify and engage potential targets without the interference of humans.[22] The current research is focused on the development of new "stealthy strike/surveillance platforms that could operate alongside manned aircraft", invisible to advanced anti-aircraft systems so that they could be used for deep penetration operations in modern warfare condensed airspace.[23] Besides the U.S. efforts for the next generation UCAVs (X-45, X-47), other nations are also exploring similar technologies. The U.K. is experimenting with the Taranis, the E.U. with nEUROn, China with Lijian, and Russia with Skat.[24]

The ownership of these technologies and abilities gives the nations that possess them important advantages in case of a potential military confrontation. They are also an investment for the future and a critical component for further technological development.

Drones in the Turkish Armed Forces

The Turkish armed forces have a long history with drones. Their efforts started back in the early 1990s when they initially focused on procuring already proven drones from foreign suppliers, and at the same time initiated their own research and development efforts. The first drone that was introduced in the Turkish armed forces was the U.S.-made General Atomics GNAT 750. An initial batch of six unmanned aerial vehicles (UAVs) was delivered in 1993[25] and the total number came up to 22 in 1995. A second delivery took place in 1999 when the Turkish armed forces purchased a total of 108 Harpy UAVs from Israel.[26] The last addition to the Turkish UAV inventory was the HERON UAV in 2010, another product of the Israeli industry. The purchase was of ten UAVs,[27] with the integration of domestic produced components that were already in use in manned aircraft of the Turkish Air Force (THK).

These UAVs provided Turkey with multiple capabilities. The GNATs[28] are capable for intelligence, surveillance and reconnaissance (ISR) missions, and the U.S. successfully used them in the U.N. intervention in Bosnia.[29] Despite the problems that occurred, the GNAT proved to be a great asset. Turkey used them extensively against the guerillas of the Kurdistan Workers' Party **(**PKK), a left-wing organization that struggles for equal rights and self determination for the Kurdish minority in Turkey. They are used for surveillance, and when a target is located, the UAV supports air strikes from manned aircraft. Today, it is estimated that they are still used, although their technology is outdated.

The HARPY UAV has a different mission. Essentially, it is a loitering attack weapon which is used for Suppression of Enemy Air Defense (SEAD) missions. It is an autonomous, "Fire-and-Forget" all-weather, day/night weapon, launched from a ground vehicle behind the battle zone against enemy radar emitters. It can be programmed to overfly a certain area until a radar is activated and following the electromagnetic emissions, the Harpy explodes in its vicinity destroying its antenna.[30] The biggest advantage of this weapon is that it can fly over a designated area for a long time, which makes it more lethal than the U.S. HARM anti-radiation missile that is used for the same purpose by manned aircraft. Thus, a single HARPY can seriously limit the use of the anti-aircraft capabilities of the adversary, in a certain area for an extended period of time. It can also abort its mission, in case the target radar is deactivated, and return to its previous loitering pattern for the remaining time of its patrol.

The last addition to the Turkish inventory, the Israeli-made HERON UAV, is the most capable and sophisticated system.[31] It is a Medium Altitude Long Endurance

(MALE) UAS for strategic and tactical missions, capable for Automatic Takeoff and Landing (ATOL), and equipped with satellite communications (SATCOM) for extended range. The maximum range is 350 km and its endurance is more than 40 hours over an altitude of 30,000 ft. The Turkish version has integrated domestically designed and manufactured electro-optical sub-systems, such as the ASELFLIR-300 Tairborne thermal imaging and targeting system designed and manufactured by ASELSAN, and the FLIR system that is installed in the indigenous T-129 attack helicopter.[32] The purchase of the HERONs faced serious obstacles. These were caused because of a significant delivery delay, and later because of problems in the integration of the domestically manufactured components to the platform. These drawbacks and the rejection, by the U.S. Congress in 2008, of the request for 4 MQ-1 and 6 MQ-9 Predator UAVs, enhanced Turkey's need for domestically produced drones and provided the incentives for local industry to become the prime contractors and manufacturers of such systems. The Turkish Defense Industries Undersecretariat (SSM) had already in 2001 issued a tender for nine systems to meet the advanced reconnaissance requirements of the military with the final procurement expected to reach a level of up to 54 air vehicles.[33] In 2004, a tender for the development of a MALE UAV was released[34] and in October 25, 2013,[35] SSM awarded Tusas Aerospace Industry (TAI) the contract for the development and production of ten UAVs. The new UAV is called ANKA (Phoenix) and the first deliveries are expected to start in 2017 after several delays. Until now, the company has produced several prototypes for the development of the airframe, and the payloads and the aircraft has been tested in flight. ANKA's capabilities include day and night, all-weather reconnaissance, target detection/identification and intelligence

missions with its Electro-Optic/Infrared (EO/IR) and Synthetic Aperture Radar (SAR) payloads, and autonomous flight capability, including Automatic Take-off and Landing. Its endurance is 24 hours flying at 30,000 ft with a range of 200 km.[36] The final version that will be delivered to the Turkish military is the ANKA S, which differs from the prototype models mainly for its SATCOM capabilities.

The second UAV that Turkey is developing is called Bayraktar T2B. A contract was awarded to Kalekalip Baykar Makina industry in December 20, 2011, for the production of a "tactical UAV system that will perform reconnaissance, surveillance and intelligence for the Turkish Armed Forces".[37] The most significant feature of the project is the capability of the UAV to fire anti-tank missiles. In December 2015 the first fire and forget anti-tank missile was successfully launched from an altitude of 16,000 ft, and hit the target eight kilometers away.[38] The Roketsan's UMTAS long-range anti-tank missile was originally developed for the Turkish T-129 attack helicopter. It is a "Smart Micro Munition", especially designed for drones and enables the drone to maintain its long endurance with a full weapon load.[39] The UAV has an endurance of more than 24 hours, a cruise speed of 70 knots per hour, a range of 150 km and an operational altitude of 24,000 ft. Deliveries were expected to start in 2016, with 12 aircraft for the Turkish Army.[40]

Another aircraft that is currently under development is the Karayel UAV, produced by Vestel Defense Industry Corporation. It has similar capabilities with the Bayraktar and is capable of medium altitude long endurance operations of up to 20 hours and at altitudes reaching 20,000 ft. Its missions focus on intelligence, surveillance, and reconnaissance (ISR) duties via the aircraft's electro-optic/infrared

sensors. The company is expected to deliver six Karayels and three ground control systems to the Turkish armed forces.[41]

Besides those MALE or tactical UAVs/UCAVs, Turkey is manufacturing a series of smaller drones with significant success. The most important is the mini Bayraktar Unmanned Aerial System (UAS).[42] It is a short range, day and night, aerial reconnaissance and surveillance drone that entered service in 2007. Its biggest success is that it became the first Turkish made drone that was chosen by a foreign operator. The drone was exported to Qatar in 2012 and the purchase consisted of ten aircraft for $2.5 million.[43]

The Turkish armed forces have integrated the use of the various drones to a great degree. For example, in 2014 a convoy of ISIS terrorists was spotted by a mini UAV entering Turkey through the Syrian border. The information was processed and the terrorists were killed by Turkish army artillery.[44] In another situation in September 2016, 5 terrorists were killed by the first use of the Bayraktar UCAV against a real target.[45] In addition to Turkey's own "war against terror", which was the main reason to exploit that technology, the Turkish armed forces also use UAVs in other missions as well. After the beginning of the hostilities in Syria, mini UAVs were used for surveillance to protect the tomb of Suleiman Shah.[46] The tomb is located inside Syria at the castle of Qal'at Ja'bar, which is Turkish territory under the Lausanne treaty of 1923.

Turkey also has plans for the much awaited ANKA.[47] Ankara has been trying to compensate for its security deficiency on the Syrian and Iraqi borders by integrating these armed drones into a system with ground control stations that will provide it with aerial reconnaissance and armed-intervention capacity. It wants to cover

a 90-mile border with data links and ground control stations. The intention is to design a border security system that will allow pilots in ground stations to assume control of the Bayraktar TB2s after takeoff from their central base at Batman. Turkey has been trying to execute that plan with the Heron UAVs bought from Israel, but has encountered maintenance and operational problems.

The future for the Turkish UAV industrial base looks promising. The government has set the goal for 100% indigenous drone capabilities and their use will be increasing in the future. That notion comes not only because of the world trend for unmanned systems. It is also because of their extensive use in the country's asymmetrical war with militant Kurdish groups inside Turkey as well as in neighboring Iraq and Syria. As the Deputy Defense Minister Suay Alpay stated at a high-profile ceremony for the debut mission flight of the ANKA in February 2016, "we are now engaged in a critical anti-terror fight … These assets built by the local industry will augment our fight".[48]

That was not the first time that high-profile officials made similar statements. In 2014, President Recep Tayyip Erdoğan, Prime Minister at the time, stated that "We have reached a technological level that we can produce unmanned aircraft", because of his views of the ANKA as his "signature project in national defense modernization".[49] A few months ago, the Prime Minister, at the time Ahmet Davutoğlu, expressed Turkey's commitment to that goal and the importance of the project. At a speech at the Defense Industry Executive Committee in March 9, 2016, he praised the efforts for indigenous programs commenting that "Turkey no longer needs foreign know-how in drone production" referring also to the ANKA project.[50]

These statements cannot be perceived as just "political" statements. The overall UAV development, the desired future of the unmanned vehicles and the respective industry initiatives, have been set since 2011. In December 2011, SSM released the “UAV Roadmap (2011-2030)”, a document describing the goals for the future. SSM is not only focusing on the domestic market, but is also interested in being competitive to the UAV initiatives around the world. A dual goal is to reduce dependency upon foreign technology and increase operational effectiveness.[51]

The goals of this document are:

- To develop a common jargon for all partners working on UAV projects in national defense industry;
- To gather all national UAV systems/subsystems projects under a single roof;
- To consider the intended level of ability of UAVs in operational, industrial, and technological terms; and
- To support strategic planning in the fields of finance, resource (human/facility/equipment) management, training/consultancy, and business development/marketing in accordance with the estimated growth.[52]

In addition, SSM is aiming to expand unmanned vehicle development in the future, to include also unmanned vessels and ground vehicles, expanding significantly the abilities of the domestic industry and the potential of the Turkish armed forces.[53]

Last but not least, is the relationship of the current President of Turkey with the UAV industry. In May 14, 2016, Recep Tayyip Erdoğan’s daughter Sümeyye, was married to Selçuk Bayraktar. The President's son in law is a defense sector industrialist who runs the Baykar company that produces the Bayraktar UAVs.[54] Although it is

irrelevant if this was a "politically correct" marriage, the assumption is that the future will probably witness a wider engagement of the Turkish government with the domestic UAV industry.

For all these reasons, the UAVs are expected to maintain their role in the Turkish armed forces and their use will probably be expanded in combination with the development and the needs of the future in areas other than the airspace domain.

Drones in the Hellenic Armed Forces

The history of the first UAV in the Hellenic Armed Forces goes back to 1980. At that time, a first attempt to produce a totally new UAV was undertaken by the Hellenic Air Force (HAF) in collaboration with the Hellenic Aerospace Industry (HAI). The project's outcome was the PEGASUS I[55] UAV that was produced in small numbers for research and development purposes. Although it was a groundbreaking effort and despite the initial success, the project stalemated for several reasons. In 1990 another initiative tried to revive the program but it was again unsuccessful. Finally, in 2003, the HAF established the first UAV squadron for the operational use of the UAV. In the coming years, the relevant unmanned systems were upgraded to the newer version PEGASUS II and additional aircraft were produced. The upgraded UAV can fly to an altitude of 20,000 ft with a speed of 120 km/h and its endurance is 8 hours. It is equipped with FLIR thermal imaging for day and night operations and is used for reconnaissance and surveillance missions. Although the airframe and communication systems are produced domestically, the engine and the E/O equipment come from foreign manufacturers.

The most recent addition to the Hellenic inventory is the French constructed SPERWER tactical UAV that was purchased to meet the requirements of the Hellenic

Army (HA).[56] It is a catapult launched/parachute recovered aircraft, capable of flying at 16,000 ft. Its speed is 160 knots, its endurance is 6 hrs and its range is 200 km. The UAV is used for intelligence, surveillance, target acquisition and reconnaissance missions with near-real time video feed to ground stations. This particular aircraft is also used by other European countries including Denmark, France, Sweden and the Netherlands.[57] The program was initiated in 2002 and the deliveries of eight aircraft were completed in 2004.

As a future project, Greece is participating in the European program for the new European Unmanned Combat Air Vehicle (UCAV) called nEUROn.[58] It is an effort that started in 2005 with the participation of France, Italy, Spain, Switzerland, and Sweden. In the research and development phase, the Hellenic side is represented by HAI, along with the leading European aircraft manufacturers Dassault Aviation, Alenia Aermacchi, EADS-Casa RUAG and Saab. The UCAV, is a stealth combat UAV that can function in medium to high-threat combat zones and can carry a payload of two guided bombs. It flew for the first time in 2012 and for the time being it is used as a “technology demonstrator” to explore new operational concepts for a future generation of autonomous stealth fighter aircraft that will be produced beyond 2020.[59] The nEUROn program is designed to validate the development of complex technologies representing all mission systems: high-level flight control and stealth, launching real air-to-ground weapons from an internal bay, integration in the C4I environment, innovative industrial collaboration processes, etc.[60]

Outside these efforts there is no other national project related to the development of UAVs. There are only initiatives of the private sector where industries and universities

run programs like the Hellenic Civil Unmanned Aerial Vehicle (HCUAV).[61] Three universities and three companies joined their efforts for this project that started in 2013 and the HCUAV made its maiden flight in 2016. Its endurance is 9 hrs, with a range of 200 km. The UAV will be used for surveillance, search and rescue missions and, potentially, for the delivery of medicine and medical equipment to the remote Greek islands.[62]

In general, a national plan is not in place to set priorities and requirements for exploring the potential production and use of UAVs in the civilian as well as the military sector. In recent years, the Hellenic Armed Forces identified the need for upgraded information capabilities at the strategic level, and it is now possible for all services to have access to integrated products of both UAVs. Although the need for accurate and time sensitive information at the tactical brigade formations and up to the strategic level is more or less satisfied, the lack of a certain class of UAVs for the lower levels of command is evident.[63] Especially at the company and battalion level there is no technological equivalent to provide the necessary intelligence for situational awareness at a distance up to 30-40 km in front of deployed troops.

Furthermore, the capability to target and destroy high value/time sensitive targets or the denial of use of a certain area to the enemy in areas that cannot be done with "traditional means," is designated to manned aircraft or to the Special Forces. Thus, the absence of UCAV capabilities elevates the burden of the air and commando forces with additional missions, increasing the risk of personnel and manned platform losses that could be mitigated with other assets.

Greece and the Turkish Threat

As described above, the Turkish Armed Forces have already made significant progress adopting the use of the UAVs and have well integrated them in their operational planning. The expected addition of drones capable of firing anti-tank missiles will expand their capabilities and thus pose a new threat to Hellenic defense plans.

In a potential conflict between the two countries the UAVs will be a key asset. It is expected that they will be used in the same manner that we have seen until today in the war against the PKK, and the engagement in Syria against the Islamic State.[64]

It is presumed that UAVs will primarily be used for surveillance and reconnaissance missions, probably before the start of hostilities both at the tactical (e.g., Greek island defenses), and the strategic level (e.g., monitoring and recording long-term patterns of Hellenic Armed Forces reactive deployments). Due to the particularity of the geography of Greece, the UAVs are extremely useful for several reasons. The wide plains in the northeast Greek provinces allows the observation at long distances beyond the Greek-Turkish borders, making the use of Turkish UAVs flying at altitude especially valuable. On the other hand, the proximity of the Greek islands to the Turkish coastline in the eastern Aegean Sea makes it possible for the UAVs flying at 20,000 ft to have all of the major islands in sight, even flying well behind the Turkish coastline. That makes them ideal for tracking and directing long-range fires as well as performing Battle Damage Assessment (BDA). The armed UAVs, because of these advantages can track and engage targets very easily, thus posing a major threat for the Hellenic Army armored and mechanized units that are prepositioned in these islands. Additionally, the limited geographic area of these islands makes it easier to find

and target high-value targets. For example, the commanders of the forces stationed there, which in a different case would be the targets of Special Operation Forces (SOF), can now be eliminated more easily by a "direct" drone strike. Furthermore, since the defense is based in permanent fortifications, lucrative targets such as command or communication installations can be targeted with pinpoint accuracy from drones rather than large formations of manned aircraft. Last but not least, the HARPYs will probably be among the first assets that will be engaged. Available in large numbers (over 100), they will be used to destroy the early warning radar grid, decreasing the capabilities of the air defense system, especially in the island complex.[65] They will also be used to suppress and destroy the mobile and static Short Range Air Defense (SHORAD) batteries of the Hellenic Army, giving the opportunity to the Turkish Air Force (THK) to establish local air superiority.

Beyond the unmanned capabilities that Turkey has already developed, we can expect even more to be added in the near future. That can be foreseen because of the experience of their use, the development of the industrial base, the accumulated knowledge of the private sector, the global trends, and the technological capabilities that Turkey has already developed in other areas.

The future of the Turkish UAV program is stated in the already published roadmap. Besides that, new specific capabilities can be developed on the basic principles that other countries have already started to explore.

The first potential area of development is the integration of manned and unmanned aircraft (MUM). The U.S. Army has already demonstrated that capability. In 2006, an AH-64D Apache attack helicopter controlled the payload of an RQ-5B Hunter

UAS to illuminate a target for its own Hellfire missiles. The newest version, AH-64 BLK III, can almost fully control an unmanned vehicle and exploit all of its capabilities.[66] Turkey already operates the T-129 ATAK helicopter, which is co-produced by Agusta-Westland Italy, and the Turkish Aerospace Industry (TAI).[67] The helicopter has similar capabilities with the AH-64 and so we could expect in the future the development of corresponding MUM capabilities.

In the same perspective, the U.S. Air Force (USAF) is exploring similar technologies for its manned aircraft. The concept is called “loyal wingman”, where Remotely Piloted Aircraft (RPA) will be linked to manned aircraft formations and be used in SEAD, ISR and other missions.[68] As stated by a USAF chief scientist, these capabilities could be used by the F-35 JSF fifth-generation multirole fighter, in order to tackle advanced Anti Aircraft (A/A) systems such as the Russian S-400/S-500 surface-to-air missiles and their supporting radars and command and control electronics.[69] It is profoundly important that the upcoming addition of the F-35 JSF to the THK inventory will create new research opportunities for the Turkish industry to couple the aircraft with the unmanned platforms. Remote direction of UAVs can also be feasibly achieved through the use of the Turkish Air Force (THK) Boeing-Grumman E-7T AWACS platforms. Such remote UAV guidance capabilities were initially demonstrated on an experimental basis possibly as early as 2007.[70] Naturally, the exercise of command and control of UAV systems from AWACS platforms requires appropriate communications links and control software.

Another domain where we can expect new developments for unmanned vehicles is the sea. Turkey has already stated its intention to build, among others, Unmanned

Underwater Vehicles (UUVs) by 2022.[71] That development could overturn the balance between the Greek and Turkish navies in the Aegean Sea. Capabilities like port security, harbor defense, and mine clearance operations are crucial for any modern navy.[72] Future UUVs could also patrol in designated areas to reveal and track submarines, making it extremely hard to hide anywhere in the Aegean Sea or the Southeastern Mediterranean.

Greece on the other hand has addressed effectively all these existing or expected threats. The smaller drones (mini and micro) fly in relatively small altitudes and if identified visually they can be destroyed by A/A guns or even guns with smaller caliber. The UAVs that operate in higher altitudes (MALE, HALE), due to their slow speeds and the absence of countermeasures, are relatively easy targets for A/A missiles even though the primary mission of such weapons is the interception of manned aircraft which are more valuable assets. Several incidents in past conflicts showed that UAVs are also vulnerable to aircraft interdiction when on several occasions in the past they were destroyed by missiles launched by MiG or F-16 fighter aircraft.[73]

In a potential conflict between Greece and Turkey, Greece cannot rely only on its A/A weapons or its HAF assets to eliminate or degrade the Turkish UAV threat. A solution that has already been identified is the attack by an active jammer designed to disrupt the communications between the ground control station and the unmanned vehicles. This disruption will not destroy the aircraft itself but it will force it to abort its mission and return to its base.[74] For the tactical UAVs this solution might not be always applicable because of the increased distance between the UAV and the jammer. In that case it is possible for the jammer to be airborne,[75] probably on another UAV. For the

more advanced UAVs that are capable for more autonomous operations, Greece should explore the potential of a cyber attack in order to take control of the targeted vehicle and retrieve it or force it to crash.

Recommendations

Although the Hellenic Armed Forces have been exploring and using these technologies for many years, the limited number and categories of relevant assets and the very small progress of the indigenous programs cannot be considered as an investment that will produce a serious and sustainable outcome for the future. The efforts of the HAF have produced limited results disproportional to the time spent, while the efforts in the private sector are still in very early stages and evolve at a slow pace. It is very important for Greece to invest seriously in these technologies because it will provide long-term benefits, especially for national security purposes, by reducing the operating cost and the risk of using other assets and personnel to accomplish the tasks that UAV/UCAVs can perform.

UAV platforms can perform their main tasks for ISR in greater areas than what is possible today, and can provide valuable data increasing the situational awareness in all levels of command where such platforms do not currently exist. They can also be used in patrolling the sea borders in the Southern and Southeastern Aegean Sea, monitor the maritime activity where no maritime surveillance radars exist, and replace the naval and air assets that are responsible for these activities now. At the same time they can reduce the use of Hellenic Coast Guard and Navy assets that patrol the Eastern Aegean Sea for migrants, and monitor and record the violations of Greek territorial waters. Similarly, unmanned systems can play a crucial policing and early warning role in the protection of critical infrastructure that connects the Greek mainland

with the Greek islands in the Aegean Sea, e.g., undersea power transmission and communications cables.

The discovery of undersea energy deposits in the Eastern Mediterranean (e.g., substantial and exploitable undersea natural gas deposits have been confirmed in the respective exclusive economic zones or EEZs of Cyprus, Israel, Egypt and Lebanon)[76] signifies the important and strategic role that UAV systems can and should play in policing the Greek EEZ and its natural resources. It is unquestionable that such systems are an indispensable force multiplier that can timely optimize the deployment of maritime and air assets allocated to the protection of the Greek EEZ. In view of the continuous economic crisis in Greece and the fiscal budgetary constraints imposed on the operations of the Hellenic Armed Forces, the use of unmanned systems can provide a critical degree of efficiency in the deployment and timely concentration of air and maritime manned platforms when and where threat conditions warrant.

Greece should also seek to expand its capabilities with UCAV platforms that can provide additional options against tank formations either as stand-alone platforms or in conjunction with the existing AH-64 attack helicopters integrating MUM capabilities. Other tasks for the UCAVs could also include search and destroy missions for hi-value targets, denial of access in certain areas, SEAD, or even anti-aircraft missions. The nEUROn project is an option for the future but the production of a smaller indigenous platform should be sought to provide adequate capabilities in the near future with significantly lower cost. Since Greece is a maritime nation, the research on the Unmanned Aerial Vehicles domain could benefit future research for Sea/Underwater Unmanned Vehicles. These platforms could provide the Hellenic Navy with unique

capabilities. For example they could patrol important channels between the islands denying access to hostile vessels, track and destroy enemy submarines, or provide security by guarding sensitive naval bases.

By exploring these new technologies and expanding its knowledge in the UAV/UCAV domain, Greece will also benefit by countering the corresponding and rapidly growing Turkish capabilities. The vulnerabilities of these assets are already known but varying in size, speed and altitude, each platform needs a different approach to tackle. A domain that the research should be focused on is the disruption of the satellite communications between the platform and the ground control stations since it is the most difficult to interfere.

The key factor that will make feasible all these concepts for Greece and will accelerate the research and development of these capabilities is the centralization of the effort under one agency with a triple role. This agency should be responsible for setting the requirements of the platforms needed, combine, coordinate and fund R&D between military, industry and the academic community and plan for future requirements. Since the main benefactor and user will be the military, that agency could be the General Directorate for Defense Investments and Armaments (GDDIA) under the ministry of National Defense. GDDIA is responsible for the acquisition of all military equipment and can be the focal point of the national effort as an interagency/intergovernmental organization that will combine the requirements of the military and other government services. GDDIA is already in close collaboration with the indigenous industry and manages the funds for the majority of the military programs for

acquisitions and maintenance. Thus it has already the basic structure needed to be in charge of such an effort.

Conclusion

As described in this paper, Turkey currently poses a significant national security threat to Greece. The increase in Turkey's military strength in combination with its revisionist policies increases the risk of a conflict between the two countries. Greece, in order to maintain stability in the region, should possess military forces that will discourage Turkey from taking any offensive action, within the constraints of a reduced budget. In such an environment, the investment in technology can provide force multiplier solutions and compensate the financial constraints and related operational limitations. The domain of Unmanned Vehicles has already proven its capabilities worldwide and their use in the Hellenic Armed Forces has already demonstrated the usefulness of these platforms. Under these circumstances it is feasible for Greece to advance in the research and production of UAV/UCAVs that will provide new capabilities while simultaneously reduce risk and cost in all branches of its Armed Forces.

Endnotes

[1] Hellenic Republic Ministry of Foreign Affairs, "Territorial Sea- Casus Belli," December 12, 2016, http://www.mfa.gr/en/issues-of-greek-turkish-relations/relevant-documents/territorial-sea-casus-belli.html (accessed February 14, 2017).

[2] Nick Danforth, "Turkey's New Maps Are Reclaiming the Ottoman Empire," *Foreign Policy Online*, October 23, 2016, http://foreignpolicy.com/2016/10/23/turkeys-religious-nationalists-want-ottoman-borders-iraq-erdogan/ (accessed Feb 14, 2017).

[3] Monash University, "Remote Piloted Aerial Vehicles: An Anthology," http://www.ctie.monash.edu/hargrave/rpav_home.html#Beginnings (accessed December 4, 2016).

[4] John David Blom, *Unmanned Aerial Systems: A Historical Perspective* (Ft Leavenworth, KS: Combat Studies Institute Press, 2010), 46.

[5] Ibid.

[6] Ann Rogers and John Hill, *Unmanned: Drone and Global Security* (London: Pluto Press, 2014), 15.

[7] Paul J. Singer, *Military Robots and Drones: A Reference Handbook* (CA: ABC-CLIO, LLC, 2013), 11-12. The German Luftwaffe also utilized radio-controlled bombers during WW II (e.g., Junkers Ju-88) with explosive loads flown by a "parent" aircraft (e.g., Messerschmitt Me-109 or Focke Wulf Fw-190) that was initially paired to the bomber in flight until separation. These composite aircraft of the *Mistel* (Mistletoe) program were primarily utilized against bridge targets with limited tactical success in the Eastern Front. See http://www.fiddlersgreen.net/models/aircraft/Mistel-Bomber.html (accessed February 21, 2017).

[8] Blom, *Unmanned Aerial Systems*, 58.

[9] Rogers and Hill, *Unmanned: Drone and Global Security,* 24.

[10] Blom, *Unmanned Aerial Systems*, 72.

[11] Rogers and Hill, *Unmanned: Drone and Global Security,* 31.

[12] Ibid., 34-36.

[13] John Kaag, Sarah Kreps, *Drone Warfare* (Cambridge: Polity Press, 2014), 25-26.

[14] John R. Emery, Daniel R. Brunstetter, "Drones as Aerial Occupation," *Peace Review: A Journal of Social Justice* 27, no. 4 (2015): 424-431.

[15] Peter L. Bergen and Daniel Rothenberg, *Drone Wars: Transforming Conflict, Law, and Policy* (New York: Cambridge University Press, 2015), 129-155; Sarah Knuckey, *Drones and Targeted Killings: Ethics, Law, Politics* (New York: International Debate Education Association, 2015), 182-186.

[16] Medea Benjamin, *Drone Warfare: Killing by Remote Control* (London: Verso, 2013), 210.

[17] Kaag and Kreps, *Drone Warfare*, 41.

[18] *Jane's Defence Weekly*, April 6, 2016, https://janes.ihs.com/Janes/Display/1766397 (accessed June 14, 2016). The Israeli Harop/Harpy loitering UCAVs have anti-radar attack capabilities. The Harpy is capable of attacking the radar systems of moving surface warships.

[19] Bergen and Rothenberg, *Drone Wars,* 300-301.

[20] Jeremiah Gertler, *U.S. Unmanned Aerial Systems* (Washington, DC: U.S. Library of Congress, Congressional Research Service, January 3, 2012), 30.

[21] Jeremiah Gertler, *Air Force Next-Generation Bomber: Background and Issues for Congress* (Washington, DC: U.S. Library of Congress, Congressional Research Service, December 22, 2009), 5, 20.

[22] Frank Sauer, "Stopping Killer Robots: Why Now Is the Time to Ban Autonomous Weapons Systems," *Arms Control Today* 46, no. 8 (2016): 9.

[23] Gertler, *U.S. Unmanned Aerial Systems*, 47.

[24] *BAE Systems Home Page*, http://www.baesystems.com/en/product/taranis# (accessed December 7, 2016); *Dassault Aviation Home Page*, http://www.dassault-aviation.com/en/defense/neuron/introduction/ (accessed December 7, 2016); "China's Lijian UCAV" Sharp Sword" Spotted Taxiing," *Defense Update,* May 18, 2013, http://defense-update.com/20130518_lijian-sharp-sword-taxi.html (accessed December 7, 2016); "Meet Skat Russia's Stealthy Drone," *Foreign Policy*, June 3, 2014, http://foreignpolicy.com/2013/06/03/meet-skat-russias-stealthy-drone/ (accessed December 7, 2016).

[25] Rogers and Hill, *Unmanned: Drone and Global Security,* 31.

[26] Aaron Stein, "Turkey's Missile Programs: A Work in Progress," *EDAM Non-Proliferation Policy Briefs* 1 (January 2013): 1-8.

[27] "Turkey to get Heron UAVs with Local Payloads," *IHS Janes Defense Weekly,* September 8, 2005, http://janes.ihs.com.usawc.idm.oclc.org/Janes/Display/1174164 (accessed March 13, 2017).

[28] Andreas Parsch, "Directory of U.S. Military Rockets and Missiles Appendix 4: Undesignated Vehicles," http://www.designation-systems.net/dusrm/app4/gnat.html (accessed March 13, 2017).

[29] Frank Strickland, "An Insider's Perspective on Innovation during Fiscal Austerity, The Early Evolution of the Predator Drone," *Studies in Intelligence* 57, no. 1 (March 2013): 6.

[30] "Harpy Air Defense Suppression System," *International Online Defense Magazine,* http://defense-update.com/directory/harpy.htm#con_ (accessed March 13, 2017).

[31] Israel Aerospace Industries, "Heron," http://www.iai.co.il/2013/18900-16382-en/BusinessAreas_UnmannedAirSystems_Heron Family.aspx (accessed March 13, 2017).

[32] Turkish Aerospace Industries, Inc., "T-129 Attack Helicopter," https://www.tai.com.tr/en/project/atak (accessed March 13, 2017).

[33] "Turkey Opens UAV Contest to Local Companies," *IHS Janes Defense Weekly*, August 31, 2001, http://janes.ihs.com.usawc.idm.oclc.org/Janes/Display/1161473 (accessed March 13, 2017).

[34] Stein, "Turkey's Missile Programs," 1-8.

[35] Undersecretariat for Defence Industries, "ANKA-S Project," http://www.ssm.gov.tr/home/projects/Sayfalar/proje.aspx?projeID=201 (accessed March 13, 2017).

[36] Turkish Aerospace Industry, “ANKA Multi-Role ISR System,” https://www.tai.com.tr/en/project/anka-medium-altitude-long-endurance-uav-system (accessed March 13, 2017).

[37] *Undersecretariat for Defence Industries Home Page,* http://www.ssm.gov.tr/home/projects/Sayfalar/proje.aspx?projeID=157 (accessed December 10, 2016).

[38] “Turkey's First Drone Hits Target from 8 km Away,” *Daily Sabah Business*, December 18, 2015, http://www.dailysabah.com/money/2015/12/19/turkeys-first-drone-hits-target-from-8-km-away (accessed March 13, 2017).

[39] Tamir Eshel, “Turkish UMTAS Missile Dropped from a Bayractar Tactical Drone,” *Defense Update,* December 19, 2015, http://defense-update.com/20151219_umtas_bayraktar.html (accessed December 10, 2016).

[40] Meti Gurcan, “Turkey Goes All In on Drones,” *Al Monitor*, December 28, 2015, http://www.al-monitor.com/pulse/originals/2015/12/turkey-drones-what-is-ankaras-hurry.html (accessed December 10, 2016).

[41] “Turkish-made Unmanned Aerial Vehicle in Testing,” *Daily Sabah Tech*, June 2, 2014, http://www.dailysabah.com/technology/2014/06/02/turkishmade-unmanned-aerial-vehicle-in-testing (accessed December 10, 2016).

[42] Baykar Makina, “Bayraktar Mini UAS,” http://baykarmakina.com/en/sistemler/bayraktar-mini-iha/ (accessed December 10, 2016).

[43] Ümit Enginsoy, “Turkey Sells Mini Drones to Qatar,” *Hurriet Daily News*, March 13, 2012, http://www.hurriyetdailynews.com/turkey-sells-mini-drones-to-qatar.aspx?pageID=238&nID=15862&NewsCatID=344 (accessed December 10, 2016).

[44] “Gözcü Buldu Firtina Vurdu,” *Daily Sabah*, February 4, 2014, http://www.sabah.com.tr/ekonomi/2014/02/04/gozcu-buldu-firtina-vurdu# (accessed December 10, 2016).

[45] Yeni Şafak, “Yerli İHA ilk harekatında 5 teröristi vurdu,” (“The IHA Hit 5 Terrorists in its First Campaign”), September 8, 2016, http://www.yenisafak.com/gundem/yerli-iha-ilk-harekatinda-5-teroristi-vurdu-2528552 (accessed December 10, 2016).

[46] Muhammet Metin, “Gözcü mini insansız hava aracı Süleyman Şah türbesini gözetleyecek,” (“Mini Unarmed Aerial Vehicle Guards Soloman Shah Tomb”), *Kokpit Aero,* May 5, 2014, http://www.kokpit.aero/gozcu-mini-iha-suleyman-sah-turbesini-gozetleyecek (accessed December 10, 2016).

[47] Meti Gurcan, “Turkey Goes All In on Drones,” *Al Monitor*, December 28, 2015, http://www.al-monitor.com/pulse/originals/2015/12/turkey-drones-what-is-ankaras-hurry.html (accessed December 10, 2016).

[48] Burak Bekdil, “Turkey Eyes Self-Sufficient Drone Industry,” *Defense News*, March 16, 2016, http://www.defensenews.com/story/defense/air-space/2016/03/16/turkey-anka-drone/81883556/ (accessed December 10, 2016).

[49] Burak Bekdil, “Turkey’s Unmanned Ambitions Shift up Gear,” *Hurriet Daily News*, June 3, 2014, http://www.hurriyetdailynews.com/turkeys-unmanned-ambitions-shift-up-gear.aspx?PageID=238&NID=67292&NewsCatID=348 (accessed December 10, 2016).

[50] Burak Ege Bekdil, “Turkey Panel OKs $5.9 Billion in Defense Programs,” *Defense News*, March 9, 2016, http://www.defensenews.com/story/defense/policy-budget/budget/2016/03/09/turkeys-government-approves-programs-worth-billions/81567424/ (accessed December 10, 2016).

[51] Sinem Kahvecioglu and Hakan Oktal , “Turkish UAV Capabilities as a New Competitor in the Market,” *International Journal of Intelligent Unmanned Systems* 2, no. 3 (August 2014): 183-191.

[52] Ibid.

[53] Ibid.

[54] “Erdoğan's Daughter, Defense Industrialist get Married,” *Hurriet Daily News*, May 14, 2016, http://www.hurriyetdailynews.com/erdogans-daughter-defense-industrialist-get-married.aspx?pageID=238&nID=99177&NewsCatID=341 (accessed December 10, 2016).

[55] Lampros S. Skartsis, *Greek Vehicle & Machine Manufacturers: 1800 to Present, a Pictorial History,* 3rd ed. (Marathon, Greece: University of Patras Library and Information Center, 2012), 247-249.

[56] SAFRAN Electronics, “Sperwer System,” http://www.safran-electronics-defense.com/land-defense/tactical-uav-systems/sperwer-system (accessed December 11, 2016).

[57], “Greece becomes Fifth Army to Order Sperwer Drones,” *IHS Janes Defense Weekly* October 25, 2002, http://janes.ihs.com.usawc.idm.oclc.org/Janes/Display/1165585 (accessed March 13, 2017).

[58] *Hellenic Aerospace Industry Home Page*, http://www.haicorp.com/en/products-en/rd-en/neuron-en (accessed December 11, 2016).

[59] Lynn E. Davis et al., *Armed and Dangerous? UAVs and U.S. Security* (Santa Monica, CA: RAND Corporation, 2014), 8.

[60] Dassault Aviation, “UCAV World First Dassault Aviation,” http://www.dassault-aviation.com/en/dassault-aviation/press/press-kits/ucav-world-first-dassault-aviation/ (accessed December 11, 2016).

[61] *Hellenic Civil Unmanned Air Vehicle Home Page*, http://www.hcuav.gr/index.php/en/ (accessed December 11, 2016).

[62] Real News, “Μη Επανδρωμένο Αεροπλάνο Κατασκευάζουν Έλληνες Επιστήμονες,” (“Greek Scientists Build Non-Manned Airplane”), May 11, 2014, http://www.hcuav.gr/attachments/article/73/RLN_1105_043_CMYK.pdf (accessed December 11, 2016).

[63] Andrew Feickert, *The Army's Future Combat System (FCS): Background and Issues for Congress* (Washington, DC: U.S. Library of Congress, Congressional Research Service, May 5, 2006), 36-37.

[64] Metin Gurcan, "In Struggle against PKK, Turkey takes Flight," *Al-Monitor,* October 14, 2016, http://www.al-monitor.com/pulse/originals/2016/10/turkey-pkk-learn-from-isis-drones.html (accessed March 13, 2017); "Turkish UAV and Artillery Strikes Kill 34 Islamic State Militants in Northern Syria," *Janes IHS Markit*, May 1, 2016, https://janes-ihs-com.usawc.idm.oclc.org/TerrorismInsurgencyEvents/Display/JTIC_479810 (accessed March 13, 2017).

[65] "Turkey Executive Summary, Air Force Unmanned Aerial Vehicles," *Janes IHS Markit*, https://janes-ihs-com.usawc.idm.oclc.org/Janes/Display/1319137# (accessed March 13, 2017).

[66] U.S. Department of Defense, *Unmanned Systems Integrated Roadmap FY2011-2036* (Washington, DC: U.S. Department of Defense), 82, 84.

[67] Turkish Aerospace Industries, Inc., "T-129 Attack Helicopter," https://www.tai.com.tr/en/project/atak (accessed February 14, 2017)

[68] Mark Pomerleau, "Loyal Wingman Program Seeks to Realize Benefits of Advancement in Autonomy," *C4IRSNET*, October 19, 2016, http://www.c4isrnet.com/articles/loyal-wingman-program-seeks-to-realize-benefits-of-advancements-in-autonomy (accessed April 25, 2017).

[69] Kris Osborn, "Air Force Chief Scientist: Future Drones Stealthier - More Autonomous," October 10, 2016, http://defensesystems.1105cms01.com/articles/2016/10/10/future-drones.aspx (accessed February 14, 2017).

[70] Joe Pappalardo, "Flocking Scan Eagles: When it Comes to Operating UAVs, Six Heads aren't Better than One," *Air & Space Smithsonian*, http://www.airspacemag.com/military-aviation/flocking-scaneagles-20369494/ (accessed February 23, 2017).

[71] Aristotle Tziambiris, *The Emergence of Israeli-Greek Cooperation* (Switzerland: Springer International Publishing, 2015), 59.

[72] U.S. Department of Defense, *Unmanned Systems Integrated Roadmap FY2011-2036*, 85.

[73] Maj Jaysen A. Yochim, *The Vulnerabilities of Unmanned Aircraft System Common Data Links to Electronic Attack* (Fort Leavenworth, KS: U.S. Army Command and General Staff College, November 6, 2010), 54.

[74] Ibid., 70, 85.

[75] Ibid., 90.

[76] Michael Ratner, *Natural Gas Discoveries in the Eastern Mediterranean* (Washington, DC: U.S. Library of Congress, Congressional Research Service, August 15, 2016).