

UNMANNED AERIAL VEHICLE IN MILITARY OPERATIONS

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Abstract: *Unmanned Aerial Vehicles (UAVs) make significant contributions to the war fighting capability of operational forces. The assumption is that piloted, remotely piloted, and autonomous vehicles have advantages and disadvantages in military operations, and that these vary in strategic significance for different levels of conflict.*

Since it is essential for the U.S. defense establishment to consider the strategic and technological implications of these types of aerial vehicles, this study is devoted to addressing the issues raised by the new generation of aerial vehicles. As technological advances increase the lethality of weapons on the modern battlefield, it is inevitable that UAVs will reduce the risks to humans in combat. If there is a fundamental constraint on the development of UAVs, it is that technology promises to find purely unmanned solutions to combat but cannot deliver on that promise. Political and military authorities should approach with caution the prospect of a world in which automated systems select military targets and employ lethal ordnance.

Keywords: *drones, strike, military operations, UAV;*

Acronyms

UAV(S)	Unmanned aerial vehicles (systems)	UCAV	Unmanned combat aerial vehicles
IMINT	Imagery intelligence	HVT	High Value Targets
GCS	Ground Control Station	IS(TA)R	Intelligence, Surveillance, (Target Acquisition) and Reconnaissance

1. INTRODUCTION

1.1. UAV history

The UAV is an acronym for Unmanned Aerial Vehicle, which is an aircraft with no pilot on board. UAVs can be remote controlled aircraft (e.g. flown by a pilot at a ground control station) or can fly autonomously based on pre-programmed flight plans or more complex dynamic automation systems. UAVs have most often been associated with the military but they are also used for search and rescue, surveillance, traffic monitoring, weather monitoring and firefighting, among other things.

The beginning of UAVs started with the Austrian attack against the city of Venice with unmanned balloons loaded with explosives. That was the earliest recorded use of an UAV. Although some of the balloons worked and successfully managed to bomb The Republic, others were caught in a change of wind and blown back over Austrian lines, [1].

Later, during World War I and shortly after, using A.M. Low’s radio control techniques, the Royal Flying Corps’ Ruston Proctor Aerial Target was built in 1916. The concept was to develop a small, very simple aircraft, pack it with explosives and then guide it into a designated target. Shortly after, on 12th of September, Hewitt-Sperry

Automatic Airplane made its first flight. These two concept planes are considered the ancestors of today's cruise missiles, [2, and 7].

World War II reveals more unmanned aerial torpedo concepts developed by US Army Air Forces and Navy. Functioning on the same radio-controlled principle, many aircraft were modified to become flying bombs, some of which are: Culver "PQ-8", Culver PQ-14 Cadet, B-17 Flying Fortress and B-24 Liberator, [3].

Cold War brings an innovative use of an UAV, other than aerial torpedoes. It seemed like gathering information with an unmanned flying vehicle is safer and more efficient. To gather data from nuclear tests, several B-17 Flying Fortresses were transformed into drones in 1946. Reconnaissance drones were also built in the 1960s like the early, not so specialized Ryan Fire bee. Others followed, using a more advanced technology: YQM-94 B-Gull Compass Cope B and Lockheed D-21, [4, 5, and 6], see figure 1.



FIG. 1. UAVs history, a. YQM-94 B-Gull Compass Cope B, [5] b. Lockheed D21B [6].

1.2. Classification and missions of the UAVs

The large variety of UAVs can be classified according to several characteristics like role, range, weight, endurance, maximum altitude, wing loading, engine type etc. Classification by role for military area: ISTAR, UCAV, multi-purpose, radar and Communication Relay, aerial delivery and resupply, research and development.

UCAV stands for unmanned combat aerial vehicles. This category contains aircraft that are highly maneuverable and are able to engage in air to air combat and also provide precision weapon delivery to surface targets, see Figure 2 and Table 1.

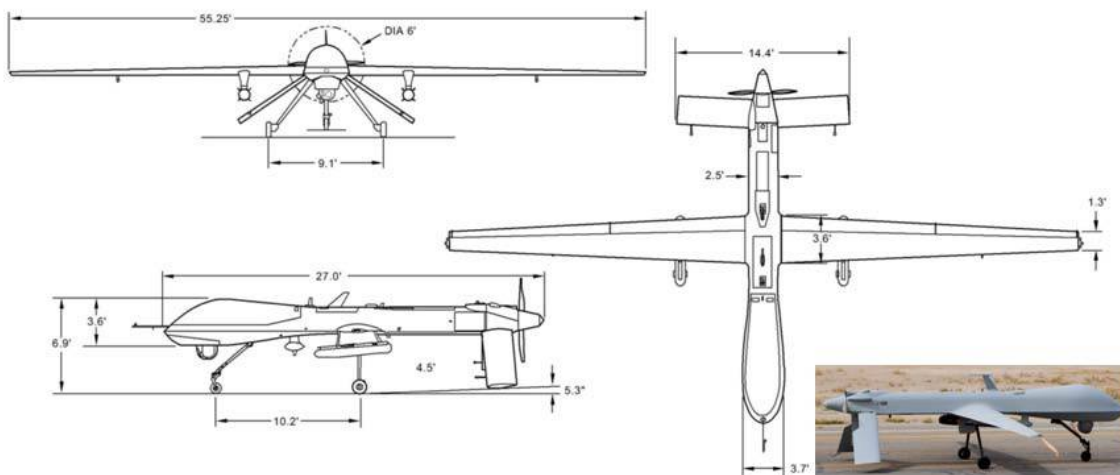


FIG.2. UCAV – MQ1 B Predator [12]

Table1. MQ-1 Predator features

Span	14,8 m	Empty weight	512 kg
Engine - Rotax	115 hp	Max. loaded	1020 kg
Maximum speed	217 km/h	Range	1100 km
Service ceiling	7600 m	Endurance	24 h

ISTAR is a system using UAVs to gather enemy information, locate target and petrol hostile air space without risking lives of the operators. Gathering such information by reconnaissance UAVs is more effective and voids putting soldier lives at risk.

Radar and communication relay UAVs are essentially an aerodynamic balloon filled with helium and air and are used for low-level surveillance system that uses aerostats as radar platforms, provide low-level trafficking or also provide television and radio signals.

Multi-purpose UAVs are usually modified reconnaissance UAVs that are weaponized. Their primary mission is usually interdiction and conducting armed reconnaissance against critical, perishable targets. These UAVs can also and strike using self-guided weapons.

The UAV in Aerial/Supply delivery category are designed for pin-point delivery of small cargo items such as ammunition and food supplies to Special Forces. The only UAV in this category is the CQ-10 Snow Goose.

The most important missions of the UAV for a civil area is: data acquisition and monitoring (e.g pipe line and power line survey, border patrol, crisis management), sports and recreation, commercial flights (e.g. agricultural operations), communications (e.g. retranslations data) and research, [13].

Considering the complexity and dangerousness of nowadays modern battlefield, the use of UAVs in military operations is mandatory. The UAV (Unmanned Aerial Vehicle), also known as UAS (Unmanned Aerial System) or commonly known as a drone is a powered, aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or non-lethal payload, [8, 9, and 10], see of communications from a UAV mission in Figure 3.

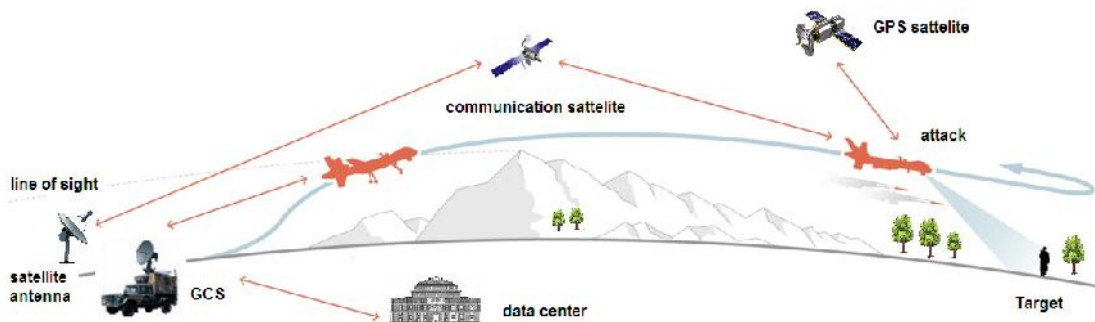


FIG.3. Data communication

2. UAV USE IN MILITARY OPERATIONS

2.1. ISTAR UAVs

ISTAR stands for information, surveillance, target acquisition, and reconnaissance. ISTAR is a practice that links sensors functions together in order to enhance battlefield functions in order to assist the combat force and manage the information collected.

UAVs enhance the ISTAR scheme through IMINT, which provide an comprehensive display of the battlefield. UAVs have proved their importance in ISTAR system in all the modern wars. The UAVs have reduced significantly the risks of collecting imagery from the battlefield, excluding the human pilot from the equation, [9, and 10].

2.2. UCAVs

An unmanned combat aerial vehicle is an UAV equipped for striking targets. It was develop in order to reduce the risk of the human pilots being behind enemy lines. The combat UAVs are capable of neutralizing targets deep in the battlefield with extreme precision and minimal collateral damage.

Combat UAVs have been successfully used in battle in Afghanistan, Pakistan, Yemen and many other battlefields. It has proved efficient and precise and the use of combat UAVs it's widespread along modern operational environments, [9, and 10].

2.3. Multi-purpose UAVs

Multi-purpose UAVs are a combination of ISTAR and Combat UAVs. The complexity of the system is an engineering challenge that was launched in 2002 by the US army. The challenge was to equip the aircraft with a high sensitivity imagery sensor and to make it capable of carrying a large amount of ammunition. General Atomics Aeronautical Systems has answered the challenge with MQ-1C Gray Eagle, [9, and 10].

3. UAV AGAINST TALIBAN

3.1. Who are the *Taliban*?

11 September 2001 was the date when the entire world started to be aware of the *Taliban*. The *Taliban* movement has its roots in religious schools in Pakistan for Afghan refugees, who fled the soviet regime. In 1994 Mullah Omar mobilized for the first time a group of 30 persons to rise against the governor of Kandahar. Soon the *Taliban* started to look good in the eyes of the oppressed people and got a lot of followers. With help from USA the in 1996 the movement became the government of Afghanistan. Starting from 1996 up until 2001 Afghanistan faced a civil war with between the mujahedeen and the *Taliban* movement. In 2001 a USA lead NATO military operation started in Afghanistan.

3.2. Why were the UAVs used against the *Taliban*?

One of the most notable uses of the UAVs has been in the counterterrorism role, both as an *intelligence, surveillance and reconnaissance* (ISR) platform and as an on-call strike platform. These armed UAVs are operated both by the U.S. Air Force and, in some cases (as with operations conducted over Pakistan), the CIA. Even before the 9/11 attacks, the armed Predator then in development were being considered as a means not only of keeping tabs on Osama bin Laden but also of killing him. Since then, armed UAVs have proved their worth both in the offensive strike role against specific targets and as a means of maintaining a constant level of threat, [11].

The insurgency type of battle the *Taliban* adopted along with the rough terrain and unknown environment for the multinational force set the perfect grounds for drone strikes against high value targets (HVT). Starting with late 2001 US drone strikes proved

effective against high value targets. Hidden locations, rough mountains, deep caves and insurgency techniques had made it almost impossible to the infantry to reach the targets. The need of a highly precise and versatile weapon appeared; that weapon proved to be the MQ-1 Predator UAV. Armed with Hellfire missiles, the Predator annihilated the HVTs that the infantry couldn't with the minimum effort and casualties, and most of the time without collateral damage.

Because in Afghanistan there were conducted US-NATO operations like Enduring Freedom and ISAF and later operation Resolute Support, most of the HVT of the *Taliban* movement were hiding in Pakistan. Status of Forces Agreement didn't allowed any "foot" operation in Pakistan, therefore the only resort of the coalition in order to neutralize the threat was to use air strikes against the strongholds of the *Taliban* leaders. The most versatile option was the UAVs like MQ-1 Predator and his larger cousin MQ-9 Reaper.

The use of the drones in current warfare operations is very controversial. There are a lot of supporters, but in the same time a lot of people and organizations are blaming the use of drones especially for the inhuman treatment towards their victims and the number of civilian casualties. At the beginning of drone usage their attacks haven't been so precise and the number of civilian victims was bigger than the number of targets killed. As the time passed the strikes became more precise and effective in the same time.

3.3 Statistics of drone strikes in Pakistan

Since 2010 the number of civilian casualties dropped from close to 20% to under 5% in 2015. The value of the targets, the impossibility of infantry troops to attack, the low number of civilian casualties and the zero loss in coalition soldiers has proved that the drones were the best choice for this type of action, see Figure 3.

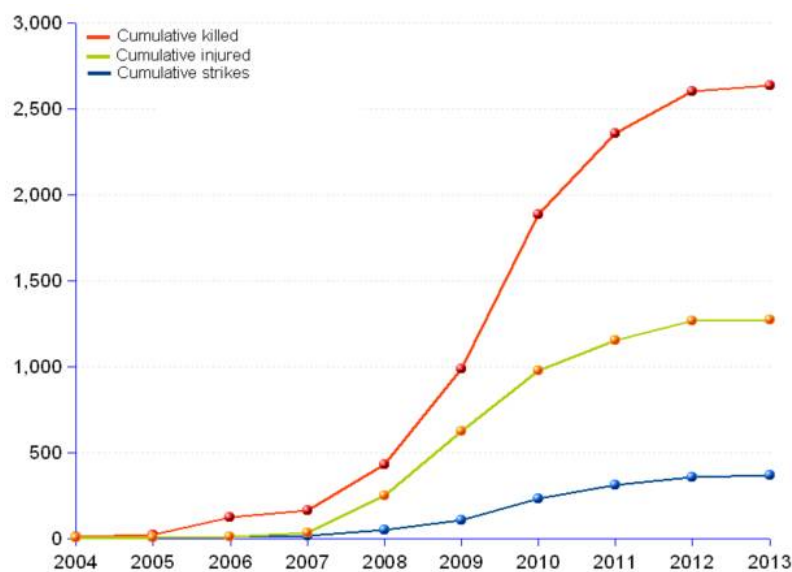


FIG. 3. Evolution UAV in military actions in Pakistan [14]

As displayed in the chart the trend is ascending, but the number of strikes has dropped in order to prioritize the targets and to reduce the collateral damage. In the same time the *Taliban* movement has lost its popularity both in Afghanistan and Pakistan.

As the years passed, the drone strikes became more precise and effective. The number of civilian killed in drone strikes has dropped significantly and the number of targets annihilated with has increased. The attacks aimed to neutralize more than one target at a time, therefore the use of the drones required more planning then before.

Public opinion played a very strong role in the change of modus of operandi for drone strikes. The decision of using drones was debated too much and the politics had to restrict the use of drones against Pakistani targets. As displayed in the chart below, the drones had increased in efficiency and accuracy and the number of collateral damage has dropped significantly. Although the number of civilians killed has decreased the public opinion has continued to accuse the use of drones against *Taliban*.

Drones are still used today in modern operational environment and had earned their place in battle. Although there have been strong controversies related to the use of drones, many high value targets were neutralized by drone strikes and a lot of soldiers' lives were saved.

CONCLUSIONS

The UAVs have a long history, but their capabilities have just started to be discovered. The military purposes, like ISTAR and strike, haven't been exploited to the maximum yet. Civilian uses of the unmanned aerial vehicles are developing every day from just entertainment up to research and rescue vehicles.

There is no doubt that recent technological advances have increased the military value of UAVs. For example, control systems have been perfected to the point where the operator needs far less experience with operating vehicles, and can focus on delivering weapons. Nor is it clear that UAVs will be less expensive to operate than their manned counterparts.

While automation can assist humans, we have not reached the point where technology will allow automated systems to make decisions about the use of lethal military force. If the objective behind the development of UAVs is find technological solutions for saving human lives in combat, it should not divert the technological community from finding better ways to integrate humans and machines into the most effective system for making the best possible decisions in war.

To reduce operating costs and losses in human and material UAV missions, synchronization strategy should include a number of areas of analysis, such as organization and doctrine, logistics and training, leadership and personnel, facilities and legislation.

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