

UNLEASH THE DRONES!

By SSG Michael Guinn

Throughout the ages, pioneers have envisioned mankind soaring through the heavens amongst creatures of flight. From the tragedy of Icarus in Greek mythology, to the modern era of drones, technological developments in aviation continue to become more sophisticated. Many would like to believe that movie concepts like “Skynet” and homicidal cyborgs were just science fiction. The truth is, these technologies may not be too far off into the future.¹ Unmanned aerial vehicles (UAV), and the complex software programs associated with them, introduce a relatively unique aerial concept into the aviation domain. Unmanned aerial vehicles as small as insects and as large as airliners are being designed for various civil and military functions. According to Merriam-Webster (2016), technology is defined as “a manner of accomplishing a task especially using technical processes, methods, or knowledge,”² and the aviation industry has only begun to scratch the surface with drone technology.

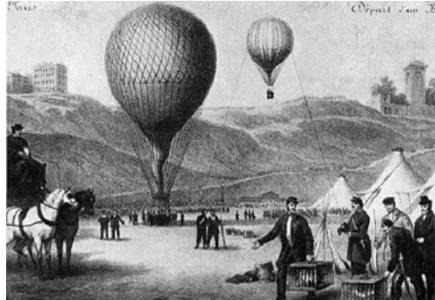
Much of society is skeptical towards the use of UAVs, mainly due to concerns of public safety and the violation of privacy; however, many organizations are starting to realize the potential that UAVs offer. Technological advances have paved the way for success and continue to surpass milestones in design and application. Unmanned aerial vehicles will be the future of aviation because they are more cost effective compared to traditional airframes, reduce the risk of property

damage and pilot fatalities, and possess a capacity to function in challenging environments while maintaining operational effectiveness.

History of Unmanned Aerial Vehicles -

Pre-Cold War Era

Many would believe that UAVs are relatively new. On the contrary, UAVs have been around for over a hundred years. Unmanned aerial vehicles have



had a profound impact, primarily on the battlefield, early on in airpower infancy. NOVA’s *Spies That Fly* presentation on the Public Broadcasting Service (PBS) noted that “years before the first manned aircraft flight on December 17, 1903, primitive UAV technology was used for combat and surveillance in at least two wars.”³ Hot-air balloons were among the first of these platforms. Being able to reach impressive altitudes for their time, balloons fitted with primitive photography equipment, provided vital information on the terrain and enemy positions and even conducted “uncoordinated”

attacks through the use of timing devices attached to a hatch at the bottom of the balloon’s basket. During the 1930s, huge advancements were made using radio waves. In 1939, an Englishman and “aviation enthusiast,” by the name of Reginald Denny, teamed up with members from the Lockheed Company to begin developing a very efficient radio-controlled aircraft.⁴ This basic UAV quickly captured the attention of the U.S. military due to its smaller design and low-cost of development. The U.S. Army realized the benefit that UAVs provided and began to evaluate their performance in different positions on the battlefield such as flying as decoy aircraft during aerial raids, conducting reconnaissance and surveillance missions, and delivering various payloads in combat with the occasional kamikaze-like attack. Aerial photography, in particular, proved very useful in the mission planning and coordination phases, enabling military commanders to make the crucial decisions needed to accomplish their objective.

Post-Cold War Era

Beginning in the mid-1960s through the 1980s, aircraft with stealth capabilities began to appear and UAVs were not excluded from this new technology. One of the first unmanned platforms to use



stealth capabilities was the American built AQM-34 Ryan Firebee. Originally designed by the United States Air Force (USAF), the Firebee proved extremely capable of carrying out the challenging missions assigned to it. NOVA's *Spies That Fly* also stated that "test flights proved that Firebee UAVs could provide covert surveillance. From October 1964 to April 1975, more than 1,000 AQM-34 Ryan Firebee UAVs flew in excess of 34,000 operational surveillance missions over Southeast Asia." Due to the demonstrated success accredited to the Firebee, other U.S. allies, such as Israel, began to acknowledge the potential for unmanned aerial operations and started to develop UAVs to satisfy their strategic and national interests. The successors to the AMQ-34 Firebee were the Israeli made Firebee 1241, the Scout, and the Pioneer. Each successive model surpassing that of its predecessor with added capabilities.⁵

made chemical and nuclear weaponry impractical. Unmanned aerial vehicles were increasingly utilized as the preferred delivery system for PGMs. For added measure, UAVs and their munitions were also fitted with the Joint Direct Attack Munition (JDAM) guidance kit which was primarily used at the beginning of Operation Iraqi Freedom and Operation Enduring Freedom to strike opposing forces with pinpoint-surgical precision. The U.S. military has been able to engage its targets in challenging locations in ways never before possible solely due to innovations such as these. Garwin asserts that "JDAMs offer the important capability of being able to work in cloud or smoke, and they can attack dozens of individual targets in a region tens of kilometers across" and "the probable error for GPS [Global Positioning System]-guided rockets of any range is likely [only] to be in the 5-meter range."⁶

Military Applications

Unmanned aerial vehicle technology continues to grow and has made a significant impact in giving the U.S. military the operational advantage it needs to accomplish its mission. Many of the platforms that the U.S. Army employs are capable of carrying a multitude of various payloads simultaneously such as Hellfire missiles, reconnaissance and surveillance equipment, imaging and measurement equipment, and communication equipment. General Atomics, creator of the U.S. Army's Gray Eagle platform, states that "Gray Eagle has an endurance of 25 hours, speeds up to 167 KTS [knots], can operate up to 29,000 feet, and carries 1,075 lbs. [pounds] (488 kg) of internal and external payload."⁷ The versatility of UAVs make them a formidable force on and off of the battlefield. In addition to being significantly cost effective, they also offer a safer alternative during hostile situations since a pilot's life is no longer placed in harm's way. With more and more features continuously being added to enhance performance, the future application of UAVs for military operations will continue to be a vital asset that compliments America's air superiority.

Civilian Applications

For decades, leaders in Washington reaped the benefits of using UAVs and it wasn't until recently that they have started to attract the attention of the civilian sector, whether it be for commercial or recreational use. Many businesses are actively looking for ways to increase work efficiency by utilizing drones to cut down on time and overall costs. The familiar online retail outlet, Amazon, is just one of many organizations that are trying to capitalize on the opportunity. By using drones for delivery, Amazon estimates that the overall delivery times for packages could be reduced significantly, shipping merchandise to consumers within minutes versus the days it currently takes. Although the size of commercial drones would limit the proportion and weight of packages delivered to a mere few pounds, this would encompass approximately three-fourths of Amazon's inventory, giving the business a significant increase in operational efficiency.⁸

Many ingenious ways of using UAVs are emerging and proving to be highly effective compared to more conventional methods. Drones tend to be very simple and require very little skill to operate in the workplace. While not limited to these applications, some foreseeable use of drones in the civilian sector are: law enforcement surveillance, weather reporting, agriculture, package and/or mail delivery, food delivery, providing aid to victims of natural disasters, herding farm animals, bridge inspections, monitoring and regulating fishing and hunting practices, mapping and other geological surveys, and search and rescue operations. Along with being used for commercial purposes, flying UAVs recreationally is quickly gaining popularity among private individuals. Although it may be fun operating a small drone, many people are unaware of the dangers associated with flying these machines. Irresponsible use of UAVs continue to be a growing nightmare for law enforcement and the Federal Aviation Administration (FAA).

Regulating the use of Drones

The societal benefit of operating UAVs

Previous conflicts mainly used UAVs for surveillance or in a defensive capacity. But, the U.S. eventually determined that it was time to assess the performance of UAVs in more of an offensive role on the battlefield. This idea was brought to fruition during the beginning of the Gulf War and continues in present day Iraq and Afghanistan. The need to minimize civilian casualties and collateral damage has always been a challenge. The development of precision guided munitions (PGM) have greatly reduced inaccuracies on the battlefield and have



within the National Airspace System (NAS) prompted Congress to enact the FAA Modernization and Reform Act of 2012, mandating that the FAA establish regulatory guidance governing the safe and orderly operation of unmanned aircraft systems (UAS). The FAA explains in detail the rules regarding the use of UAS in the Small UAS Rule (Part 107) which took effect on August 29, 2016. Within the text of this sizable publication, the FAA meticulously outlines the parameters required to be met in order to legally and safely operate a drone within the NAS. Some of the criteria to be met include: drone operators must establish two-way communication and obtain authorization from air traffic control prior to operation unless operating within Class G* airspace, the total weight of the drone to include its payload and attachments must be under 55 pounds, drones may only operate up to 400 feet above ground level and must not exceed a ground speed of 100 mph, flying of drones is only permitted in daytime hours under visual meteorological conditions, and drones must remain within line of sight of the operator at all times.⁹ Drone pilots will be required to adhere to the strict rules and regulations governing UAS operations. Those who violate any of the rules outlined within the Small UAS Rule Part 107 may have their privileges revoked and may be subjected to imprisonment and penalties imposed upon them by federal and state laws.

The Financial Benefits of Drone Use

So why exactly have UAVs been gaining popularity in the recent decades? One critical element that has swayed government officials is the economics involved with employing such systems, or in layman's terms - money. Even though they require control stations and other equipment to operate, the cost benefit of using UAVs is compellingly less expensive compared to using conventional airframes for most jobs.

Our enemies, well aware that they could never take on the United States in a conventional war, employ such tactics as "attrition" in an effort to cause economic hardship and eventually collapse to the infrastructure of the United States. Using



terror tactics to place fear into the hearts and minds of its citizens is extremely effective in forcing a nation into overspending on its national security. The U.S. government decided to take a page from the history books and realized that overspending on a defense budget was one of the major factors that caused the collapse of the Soviet Union during the Cold War. To counter such tactics one viable solution was the implementation of drone warfare.

Like the invention of the tank and rifle, which eliminated the need for a large number of Soldiers to be present on the battlefield, drones are also proving to be remarkably cost effective to use in lieu of manned operations. In his article, *Drones are cheap, soldiers are not: a cost-benefit analysis of war*, Wayne McLean states that the estimated cost of a basic drone, such as the MQ-9 Reaper was significantly lower, a notable 93 percent cheaper in unit price and two-thirds cheaper to operate, than the USAF's new F-35 Joint Strike Fighter. Another important element in the money equation that people fail to acknowledge is the amount of money it takes to train, maintain, and place a Soldier into combat. McLean goes on to say that in 2012, the average cost to have a service member in Afghanistan "cost the government US \$2.1 million." With the advancements made in technology and in medicine, troops injured on the battlefield are more likely to survive

compared to the fatality rate in previous wars. In order to provide them with the required food and medical treatment, established facilities were needed overseas to facilitate this. There is also the large amounts of money needed to support those getting out of the military with medical disabilities in their early to late 20s and 30s. With tens of thousands of troops deployed to the austere environments of Iraq and Afghanistan, you can imagine the total amount of money that was poured into the American soldier; an estimated "US \$836.1 billion" by the height of the wars.¹⁰

Drones not only proved to be a viable solution for the U.S. defense budget, but they also demonstrated to be beneficial towards civil businesses and the jobs they created. Chris Mailey, author of *Are UAS More Cost Effective Than Manned Flights?*, discusses how the Bureau of Land Management has collected sufficient data while performing site surveys and inspections for various construction projects over the past few years, correlating the differences in cost and efficiency between manned and unmanned aircraft - the end result was astounding. He further explains that the data collected shows that the use of drones to conduct these services was up to 98 percent cheaper to operate compared to a manned aircraft, in terms of unit cost and cost per hour of flight. When pit against each other, the UAV

* Class G airspace formally known as 'uncontrolled airspace,' is airspace in which flight under instrument flight rules is normally not allowed.



almost always proved superior with being the most cost effective option while maintaining operational effectiveness. After going through the process of pre-inspections and obtaining a Certificate of Authorization from the FAA to operate a UAV for non-recreational purposes, the profit gains of transitioning over to unmanned services was reason enough to make the switch.¹¹

The Safer Alternative

The approaching robotic age is inevitable and the media tends to demonize drones because humans naturally fear what they do not understand. Recent public outcry has condemned the use of drones in the Middle East because of civilian casualties. The truth is that the military UAS possess a highly accurate targeting system which is just as efficient as a manned aircraft engaging a target. Regarding the subject of risk management, drones tend to compliment risk mitigation within the aviation realm. Bottom line up front, using UAVs in any facet over a manned aircraft not only alleviates the costly loss of a multimillion dollar airframe, but more importantly keeps the pilot out of harm's way. Unmanned flights may also reduce the risk of airborne incidents due to pilot fatigue. A perfect example for the necessity of drones in risk mitigation would be the need for a power company to survey a malfunctioning junction box, transformer, or damaged power cables. Instead of using a crane with a human being inside of the bucket to survey the damage. You can now totally eliminate the need for the vehicle, crane, and worker needed to get the job done and complete the work in a more expeditious manner using a drone. The weight limit on UAVs imposed by the FAA--under 55 pounds--would also lessen the potential damage done to property and persons, especially when you consider the catastrophic damage that can be done by a larger aircraft.

The Future of Unmanned Aerial Vehicles

Unmanned aerial vehicles appear to be the most logical choice for future aviators but how far will the technology go? NOVA asserts that various types of micro UAVs are being developed for the military and law enforcement for surveillance activities. To assist in daily

living, they go on to explain that bird-like solar powered UAVs are being developed that can achieve sustained flight for extremely long periods of time. Their primary function will be to assist satellites with broadband communication systems and Global Positioning System (GPS) tracking as a cheaper alternative to other methods. Complex software programs are constantly being developed to improve the overall performance of these machines. Many developers may be required to also incorporate anti-collision systems, some form of radar, communication, tracking equipment, and weather detection capabilities to ensure the safe, orderly, and expeditious flow of air traffic operating within the NAS. Future UAVs may completely eliminate the liability of a pilot and the need for numerous navigational aids by completely switching over to GPS tracking. Perhaps someday in the near future we can expect thousands of these tiny machines communicating amongst each other, flying about delivering messages and information to people around the globe.¹²

people are reluctant to fly and go about their daily business knowing that direct human intervention is not involved with these systems. Some of the biggest issues continue to be related to public safety and privacy concerns. What is preventing someone from weaponizing their drones or attaching cameras to them to spy on you in your backyard or bedroom window? Would drone footage captured by law enforcement be inadmissible in a courtroom if the footage was taken without a warrant? How does a growing UAV presence affect the jobs of air traffic controllers, pilots, photographers, law enforcement, etc.? Some will also claim that there is the issue of limited visibility to avoid collisions due to the absence of a pilot but this is untrue. If anything, drones have proven to be more effective due to advancements in radar, GPS, and thermal imaging capabilities. Contrary to popular belief, it would be extremely difficult to attach sizable weapons to UAVs without affecting the performance of the machine. The FAA along with law enforcement are already employing their versions of unmanned aircraft for security related missions, surveillance,



Integrating the Concept of Drone Technology into Society

Much of society today is still hesitant towards relying on UAVs to carry out their tasks. This is understandable. Whether it be for deliveries or public transportation,

and even border control. The job market, particularly in aviation, will benefit from the growing utilization of UAVs immensely since there is a never ending demand for the technical skills needed to pilot the diverse array of platforms



available, and the maintainers needed to conduct the required maintenance on them. Many people are being employed to help come up with ways on how to improve and use the technology.

Conclusion

Technological advancements could eventually lead to autonomous land, sea, and air vehicles. As with all new technologies, there will always be areas that need improvement and people will find ways to misuse it to their advantage, but it is important to remember that the benefits outweigh the negatives. Drones are best suited to provide the services we need because they are economical, mitigate injury and reduce the potential

for loss of life, and enable us to explore difficult locations with ease that would otherwise prove troublesome to reach. A question that has always seemed to plague the minds of man is: "How exactly can we prevent the possibility of wars in the future?" Having the advantage on the battlefield through air superiority is one option that may effectively deter our enemies from causing undue harm to the nation. Former U.S. President Ronald Reagan once said: "Freedom is never more than one generation away from extinction. We didn't pass it to our children in the bloodstream. It must be fought for, protected, and handed on for them to do the same, or one day we will spend our sunset years telling our

children and our children's children what it was once like in the United States where men were free."¹³ The United States of America has a moral obligation to the world and its citizens to preserve the liberty mankind is entitled to. Through a joint effort, lessons learned from history, and the ethical application of technology, destruction and terrorism may possibly become a thing of the past. Like the many innovations before it, UAVs are just another development in the never ending need for mankind to satisfy his curiosity and explore unknown horizons.



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Acronym Reference

ATS - air traffic services	PGM - precision guided munitions
FAA - Federal Aviation Administration	UAS - unmanned aircraft system
GPS - Global Positioning System	UAV - unmanned aerial vehicle
JDAM - Joint Direct Attack Munition	USAF - United States Air Force
NAS - National Airspace System	

