

Unmanned Aerial Vehicles - Benefits to the Warfighter

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It is only the enlightened ruler and the wise general who will use the highest intelligence of the army for purposes of spying, and thereby they achieve great results. Spies are a most important element in war, because on them depends an army's ability to move.

—Sun Tzu

From the first crude aerial vehicles to the current systems, unmanned aerial vehicles (UAVs) have sought to garner some advantage over the enemy. The benefits to the warfighter have also evolved over the years from basic delivery platforms to enhanced surveillance and precision delivery platforms. Future benefits might even eliminate the need for manned aerial platforms. However, the major challenges faced by troops on the ground today are not at the regimental, battalion, or even company level. The rationale behind the development of early UAVs, current UAVs, and even planned UAVs is that they support conventional operations at the company level and above, and for the most part they have provided excellent support. In the current operating environment though, particularly in Iraq and Afghanistan, troops at the platoon, squad, and fire team levels are engaging the enemy. To meet the requirements of troops at this level a major shift is needed in the development of UAVs from the traditional systems that support the "over the next hill" or "area of operation" battlefield concept to UAVs that support "close-quarter" operations. The current threat on the modern battlefield requires a greater investment in specific UAV platforms to provide immediate support to troops in contact.

HISTORY

The concept of unmanned aerial vehicles was first used in the American Civil War, when both the North and the South launched balloons with explosive devices towards each other's ammunition depots. In World War II, the United States used a prototype UAV called Aphrodite.¹ It was an attempt to use manned vehicles in an unmanned mode. However, at that time, the U.S. did not have the technology to launch or control the aircraft.

In the 1960s, the U.S. started to develop 'drones,' which were unmanned vehicles built for spying and reconnaissance. The use of these drones happened just after a manned spy aircraft was lost to the Russians and a U-2 to Cuba. The first such drone was the 'Firebee' drone, a jet propelled by an engine made by Ryan Aeronautical Company. The drones were initially used heavily over Communist China in the 1960s, after some major flaws were discovered and corrected.

The Vietnam War was the first time that UAVs, the drones in particular, were used extensively in reconnaissance and combat roles. A large number of Firebee drones, were launched for basic day reconnaissance activities. At first, they had simple cameras on them. Later, they were equipped with night

¹Garamone, Jim. "From U.S. Civil War to Afghanistan: A Short History of UAVs." American Forces Press Service, 2002, p. 1.

photographic equipment, communications equipment, and electronic intelligence equipment.

In the 1980s, Israel was responsible for much of the development in the UAV sector. The Hunter and the Pioneer, which are used extensively by the US military, are direct derivatives of Israeli systems.²

All UAVs mentioned so far were used for reconnaissance and surveillance activities at the battalion level or above. Mainly due to technological limitations, the development of UAVs to support company level operations was still in the early stages up until the mid 1980s.

CURRENT PLATFORMS

Following the Gulf War (1991), officials recognized the importance of unmanned systems. In fact, today there are five major UAV systems in use by the U.S. military. These five systems include the U.S. Air Force's Predator and Global Hawk systems, the U.S. Marine Corps' Pioneer system, and the U.S. Army's Hunter and Shadow 200 systems.

² Microsoft® Encarta® Online Encyclopedia. "Unmanned Aerial Vehicle." <http://encarta.msn.com> © 1997-2005 Microsoft Corporation. All Rights Reserved. 3 December 2005, p. 3.



**Figure 1: Predator UAV
(From: Air Force Magazine, December 2005)**

The Predator (figure 1) was the first UAV in the U.S. inventory to demonstrate its worth in the skies over the Balkans. At twenty-seven feet long and seven feet high, it has long, thin wings and a tail like an inverted V. The Predator typically operates at 10,000 to 15,000 feet for best imagery from its on-board video cameras. Each vehicle can remain on station, over 400nm away from its base, for twenty-four hours before returning home. The Predator's primary function is airborne reconnaissance and target acquisition. To accomplish this mission, the Predator is outfitted with a 450-lb surveillance payload, which includes two electro-optical cameras and one infrared camera for use at night.



Figure 2: Global Hawk UAV
(From: Jane's Defense Weekly, December 2005)

Another major UAV is the Global Hawk (figure 2). At forty-four feet long and 26,750 lbs, Global Hawk is about as large as a medium sized corporate jet. It can fly to a target area 5,400 nm away and loiter at 65,000 feet while monitoring an area the size of Illinois for twenty-four hours, then return. Besides the obvious size difference between the Predator UAV and Global Hawk, another significant difference between the two UAVs is that Global Hawk flies autonomously from takeoff to landing and in any weather.

The Global Hawk UAV has been called "the theater commander's around-the-clock, low-hanging (surveillance) satellite."³ The UAV provides a long-dwell presence over the

³ Bone, Elizabeth, and Christopher Bolkcom. "Unmanned Aerial Vehicles: Background and Issues for Congress." Congressional Research Service - The Library of Congress, 2003. pgs. 34-37.

battlespace, giving military commanders a persistent source of high quality imagery. The current imagery payload consists of a 2,000-lb integrated suite of sensors.



Figure 3: Pioneer UAV
(From: Navy UAV homepage,
<http://uav.navair.navy.mil>, December 2005)

The US Marine Corps has the Pioneer (figure 3), which was initially developed in Israel, then acquired by the U.S. Navy in 1986. The Pioneer has played a critical role in generating U.S. interest in tactical UAVs. Originally flown from Navy battleships, the Pioneer is currently being launched from amphibious ships and land based facilities. At fourteen feet long, the Pioneer is roughly half the size of the Air Force's Predator UAV. It can reach maximum altitudes of 15,000 feet, but flies an optimal altitude of 3,000 - 5,000 feet above its target. The Pioneer can stay aloft for five hours during the

daytime, and has a range of 100nm. The mission of the Pioneer is to provide real time intelligence and a reconnaissance capability to the field commander. Pioneer can be used for over-the-horizon targeting, surveillance, Naval gunfire spotting, and battle damage assessment. Its 100 lb payload consists of an electro-optical and IR camera.



Figure 4: Hunter UAV
(From: Jane's Defense Weekly, December 2005)

The US Army's Hunter UAV (figure 4) can fly at altitudes up to 25,000 feet, reach speeds of 106 knots, and spend up to twelve hours in the air. Weighing 1,600 lbs, it has an operating radius of 144nm. The Hunter's standard mission is reconnaissance and surveillance, and it is equipped with an Electro-Optical/Infrared sensor payload for day/night operations. However, it recently conducted tests of other missions, to include a helicopter manned/unmanned teaming mission and an armed mission.



Figure 5: Shadow 200 UAV
(From: Jane's Defense Weekly, December 2005)

The Army has also developed a tactical UAV called "Shadow 200" (figure 5), which gives leaders 'over-the-hill' surveillance capabilities. The Shadow 200 is eleven feet long with a wingspan of thirteen feet. It has a range of 30nm, a distance picked to match brigade operations, and an average flight duration of four hours. Although the Shadow can reach a maximum altitude of 14,000 feet, its optimum level is about 8,000 feet. The Shadow is catapulted from a rail on a launcher, and recovered with the aid of an arresting gear. The UAV has an automatic takeoff and landing capability.

The Shadow provides real-time reconnaissance, surveillance, and target acquisition information to Army brigades. A potential mission for the Shadow is the perilous job of medical re-supply. The Army is considering expanding the UAV's traditional missions to include a medical role, in which several crucial items such as blood, vaccines, and fluid infusion

systems could be delivered to troops via parachute.⁴ The Shadow's 60-pound payload consists of an Electro-Optical/Infrared sensor turret which produces day or night video, and can relay its data to a ground station in real-time via a line-of-sight data link.

In addition to the five major UAV systems in use by the US military today, there are multiple small UAVs that are generally used to give small-unit leaders a view of the battlefield. These small UAVs include the Dragon Eye, Force Protection Aerial Surveillance Vehicle, Pointer, Raven, Buster, Silver Fox, Scan Eagle, Aerosonde, and BATCAM. These small UAVs have varying weights from 1 to 40 pounds, ceilings from 1,000 to 20,000 feet, ranges from 2.5 to 1,000 nautical miles, and endurances from forty-five minutes to thirty hours.

The five major UAVs flown today are still used primarily for Intelligence, Surveillance and Reconnaissance/Target Acquisition purposes. These aircraft provide commanders with imagery intelligence, electronic intelligence, and streaming video. This information can be used for everything from directing fighter aircraft (to their targets), to monitoring enemy troop movements, and to conducting battle damage assessment. However, the DOD has recently broadened the roles

⁴ Bone, Elizabeth, and Christopher Bolkom. "Unmanned Aerial Vehicles: Background and Issues for Congress." Congressional Research Service - The Library of Congress, 2003. pgs. 31-32.

of UAVs into new missions such as armed reconnaissance. Predator is the first UAV to add the strike mission to its repertoire, stalking Taliban and Al Qaeda leaders in Afghanistan and Yemen and striking these targets with Hellfire missiles. Due to its ability to perform multiple missions as well as its success in recent military operations, UAVs have demonstrated surprisingly fast exploration of new roles.

Even with the advances to all UAVs in use today by the U.S. military, the majority of UAVs are still focused on providing information and combat power to commanders at the company level and above. Some of the smaller platforms are being used at the platoon level, which has made the jobs of personnel at this level a little easier but much more can be done to enhance the information provided to leaders at the platoon level and below.

THE FUTURE

In the future, UAVs will likely be lethal by design. Research and development platforms such as the Unmanned Combat Air Vehicle are being developed with a primary offensive mission of strike and suppression of enemy air defenses. The DOD is developing a helicopter called the Unmanned Combat Armed Rotorcraft (UCAR). The new and improved Predator, the Predator

B, will have the capability to carry eight Hellfire missiles instead of two Hellfires.⁵

DOD plans call for UAVs to play an integral role in battlefield operations. UAVs will team up with manned aircraft to carry out operational missions.⁶ The Navy is considering pairing a UAV such as Global Hawk or the Predator B with its planned multi-mission maritime aircraft, as a replacement for its aging long range patrol aircraft, the P-3C Orion. The Army envisions helicopters such as the AH-64 Apache controlling UAVs and receiving direct video feeds from the UAV. The DOD has directed the Army to add a companion UAV to its newest helicopter purchase, the RAH-66 Comanche. To make this a reality, the Army procurement plan for the armed reconnaissance helicopter was halved to 650 Comanches in 2002. The intention is that the companion UAV, such as the Shadow or UCAR, would make up for the canceled Comanches.⁷

Further in the future, large UAVs could take on the aerial refueling task now performed by KC-10 and KC-135 tanker

⁵ Bone, Elizabeth, and Christopher Bolkcom. "Unmanned Aerial Vehicles: Background and Issues for Congress." Congressional Research Service - The Library of Congress, 2003. pgs 21-25.

⁶ Reinhardt, J.R.; James.J.E.; Flanagan.E.M. "Future Employment of Unmanned Aerial Vehicles." Joint Force Quarterly, 1999. p. 1.

⁷ Office of the Secretary of Defense. "Unmanned Aerial Systems Roadmap 2005-2030." 2005. p. 8.

aircraft. Although DOD has not expressed plans for exploring the aerial refueling role, it appears to some to be a mission well suited for unmanned aircraft. Except for operating the refueling boom (to refuel Air Force aircraft), the refueling crew's primary job is to keep the aircraft flying straight, level, and at a steady speed.

Another, far more difficult future task, could be air-to-air combat. DOD is experimenting with outfitting today's UAVs with the sensors and weapons required to conduct such a mission. Aerial combat is often described as the most challenging mission for manned aircraft to perform, and, some say, one that UAVs will never be able to accomplish.

Throughout this paper so far the benefits to the warfighter are very apparent, but it should be noted that the majority of UAV usage is at the company commander level and above. What is needed is a UAV platform for warriors at the platoon, squad, and fire-team levels. UAVs developed for use at the platoon level or below is where the real benefits to the warfighter will be demonstrated by being able to fight the enemy around the next corner, behind the next wall, or through the next door/window.

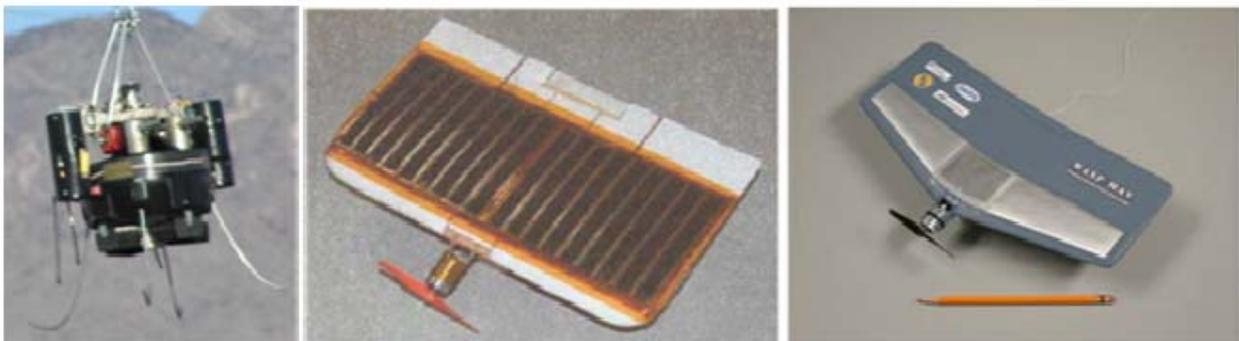


Figure 6: Micro Air Vehicles
(From: DARPA, December 2005)

The Defense Advanced Research Projects Agency (DARPA) is currently working on a \$30 million micro air vehicle (MAV) effort (figure 6). Unlike other UAVs, MAVs are measured in inches, not feet, and cost thousands of dollars instead of millions. A prototype nine-inch wide MAV, called the Organic Air Vehicle (OAV) (figure 6, top image), was delivered to the Army in 2003 for testing as part of their future combat system.

Organic Air Vehicle, which employs a ducted-fan design vice a fixed wing, carries Electro-Optical sensors and could be upgraded to include infrared and acoustic sensors, according to

its producer, Allied Aerospace. One operational advantage of a MAV, compared to a larger UAV, is the ability to conduct a "perch and stare" mission. Most UAVs perform their missions while they are flying; the MAV will be able to land or hover, and then watch, using its camera to take pictures of any movements or other signs of enemy activity.

MAVs are likely to increase in utility value once lightweight cameras become available.⁸ MAVs will be able to fly through an opening in a building and locate the enemy before troops make contact. The tactical advantage of knowing the enemy's exact fighting position, defenses, and strengths is what the MAVs bring to the fight.

CONCLUSION

The next generation of UAVs will be smaller, more affordable, easier to operate, and more precise than the existing UAVs. Also, in the foreseeable future, UAVs are predicted to be able to detect nuclear, biological and chemical weapons; see into double and triple canopy jungles; and provide low-cost, very reliable communications and enhanced data relays across the battlefield. The leaps from UAV inception to the current UAV platforms have been remarkable, and future advances

⁸ Defense Advanced Research Projects Agency website; <http://www.darpa.mil/tto/programs/mav.htm>. 3 December 2005, pgs. 1-2.

will undoubtedly benefit the warfighter. However, the emphasis needs to shift from UAVs that support the strategic and operational levels of war to systems capable of supporting the troops in house-to-house engagements. The U.S. military is at a point now where its existing UAV platforms support requirements quite well above the tactical level and can shift UAV development to win the "close-quarter" fight. Currently, the overall benefits of UAVs cannot be denied but, for the common infantryman, the real benefits will be seen with the fielding of the Micro Air Vehicles!

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