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CORPORATE FINANCE

Aerospace & Defense

ADVISORY

Fall 2009

UAVs Transforming the Defense Industry

Unmanned Aerial Vehicles (UAVs) have altered the defense industry landscape and most recently have transformed the battlefields in Iraq and Afghanistan. UAVs are advantageous because when compared to piloted military aircrafts, they protect human life, are smaller and have less-extensive electronic systems, and do not require as much fuel, runway space, or major logistics support. Currently, the market consists of several large incumbent players as well as smaller yet innovative defense contractors. With 2010 UAV spending increasing over 2009, the new fiscal year will be competitive, driving both innovation and consolidation.

The Benefits of UAVs

UAVs are particularly beneficial in missions where fatigue, health, and danger to human life are of concern.

UAVs are of significant benefit in missions of long durations that require constant attention without opportunity for rest. The longest Operation Enduring Freedom B-2 mission was just over 44 hours, and the longest Operation Iraqi Freedom B-2 mission was 39 hours. In air missions this lengthy, fatigue management becomes a major issue. Constant surveillance lasting as long as several weeks is a key priority of the Pentagon, which is planning several demonstrations in Afghanistan. One demonstration is a hand-launched UAV to carry a communication payload above 40,000 feet for two weeks and the other is a UAV to carry a 2,500-pound payload to 20,000 feet for three weeks. A UAV in place of a manned aircraft in such assignments has no issues with fatigue. The operation of each UAV is handled by shifts of UAV operators under normal mission cycles which include crew rest periods.

Missions with potential exposure to chemical agents, radioactive materials, or other unknown dangers can safely be addressed by UAVs. UAVs were utilized decades ago in this capacity when the Air Force and Navy used unmanned B-17s and F6Fs, respectively, from 1946 to 1948 to fly into nuclear clouds within minutes after bomb detonation to collect radioactive samples.[1] A major concern in modern warfare is investigating areas that could be exposed to chemical agents. Currently, Boeing is developing a UAV model that can locate, detect, track, collect, and transport chemical agents. For missions such as this, UAV technology is much better suited than piloted aircrafts.[2] Additionally, unmanned cargo aircrafts are materializing as key tools to provide logistic support, particularly in rough and unknown terrain.

Manned reconnaissance missions can present substantial danger to human life. With the landscape of war often being urban, UAVs provide an ideal alternative to humans for intelligence, surveillance, and reconnaissance (ISR). Rather than sending a team of highly trained soldiers into the heart of uncertain enemy territory to gather intelligence, a single UAV can provide ISR and in some cases, even more ISR than a human could collect. The use of UAVs for ISR, particularly to capture live video in Iraq and Afghanistan, continues to increase. Armed UAVs are also growing in popularity as more of them are equipped with precise weaponry to eliminate targets.

UAVs allow better allocation of human forces, and most importantly, they can save human lives.[1]

Evolution of UAVs

UAVs are becoming smarter, faster, and stealthier in response to greater expectations for surveillance and attack missions. Demand for UAVs has created a plethora of designs tailored to specific missions.

A few of the dominant models in service include General Atomics' Predator and its Reaper model as well as Northrop Grumman's Global Hawk.

[1] *U.S. Department of Defense,* "Unmanned Systems Roadmap 2007-2032," December 1, 2007.

[2] *Defense Industry Daily* ,"From Dolphins to Destroyers: The ScanEagle UAV," May 27, 2009.

2010 DoD Budget for UAV Models			
Model	Manufacturer	Description	($MM)
GLOBAL HAWK	NORTHROP GRUMMAN	High-altitude, long endurance reconnaissance	$608
PREDATOR	GENERAL ATOMICS	Reconnaissance or ground attack capable	$651
RAVEN	AEROVIRONMENT	Small unit reconnaissance	$79
REAPER	GENERAL ATOMICS	Larger, combat-oriented version of the Predator	$489
SHADOW	AAI	Army/Marine Corps reconnaissance	$609

Source: Company filings and Washington Technology, "DoD Requests $5.4B for Unmanned Systems Budget," June 16, 2009.

The Predator is a large UAV mainly used for reconnaissance, and the Reaper is the combat version of the Predator. The Global Hawk is designed more specifically for high-altitude long endurance reconnaissance missions. The Department of Defense (DoD) already plans to invest over US$600 million in each of these models during the 2010 fiscal year.[3]

Overlapping with the proliferation of aircraft designs is a push to establish broader technical standards and systems for control of UAVs, ultimately called Unmanned Aircraft Systems (UAS). This includes innovations in the crafts, ground control, data analysis, and related systems to operate multiple aircrafts, enable automatic decision making, and analyze captured data. There are three main focuses in the current development of UAS: autonomy, teaming, and combat capabilities.

Autonomy

Autonomy is the trend toward UAVs that function more as independent-minded robots and less as radio-controlled planes. Currently, the military mostly utilizes UAS technologies that were developed during the past decade to fly missions without putting pilots at risk. However, an issue that remains is personnel requirements on the ground, which have not improved relative to the progression in the systems. Every mission requires a two-man team of a pilot and a sensor operator, backed up by additional support personnel who help analyze sensor data. Reducing this headcount and achieving a higher level of autonomy in ISR and command controls will be an area of focus of UAV development.

For instance, the Airforce has started to deploy a multiaircraft control system (MAC) allowing a single crew to control up to four UAVs, and the next version of MAC will allow simultaneous control of twice as many planes. The planes will also fly with less supervision and will use software-based pattern recognition techniques to identify potential threats or targets and avoid collisions. The crew will provide looser supervision for operations that don't require more active control such as judging surveillance data.

Teaming

Teaming is developing technologies and techniques for strategically using UAVs in combination with manned aircrafts. Known as the loyal or "robotic wingman" approach, UAVs fly alongside manned aircrafts to act as force multipliers. The Army is applying this trend by sending UAVs as advance scouts for Apache helicopter crews, who can watch video feed and make combat decisions based on the information received by UAVs.[4] Unarmed UAVs frequently perform ISR and laser-target identification in coordination with Apache helicopters. Armed UAVs can add additional firepower and act as decoys to overwhelm the target.[5]

Combat Capabilities

The demand for armed UAVs has increased due to the frequent missed opportunities of operators discovering high-value targets, only to watch them escape because of the time it took to call in an air strike. As a result, more UAVs are carrying weapons even though ISR remains UAVs' primary mission.

Typically, UAVs are not designed with the kind of performance characteristics associated with fighter jets. The most combat-oriented craft fielded to date, the Reaper, has a turboprop engine, and smaller models are propeller planes powered by gasoline, diesel, or electric engines. These designs are optimized less for speed and more for the ability to loiter over a potential target and study it for an extended time. However, this combat method is evolving with the addition of smaller, lighter, more precise weapons that can hit a target with minimal potential for collateral damage.[4]

The UAV Market

Despite the pending drawdown in Iraq and potential DoD budget cuts, the UAV market will continue to see steady growth as the demand for the technology remains strong. As the United States and allied military forces increasingly focus on fighting noncon-ventional opponents such as terrorists, insurgents, and heavily armed criminals, they face a growing need for advanced surveillance and reconnaissance equipment. As far back as 2001, the U.S. Congress established goals of having one-third of aircrafts in the operational deep strike force unmanned by 2010, and one-third of operational ground combat vehicles unmanned by 2015. Given the success of these devices in locating and attacking enemy forces and keeping U.S. and allied military personnel safe for a fraction of the cost of a manned aircraft, the relative importance of these systems will continue to increase over time. The Pentagon is taking aggressive steps to institutionalize unmanned systems in the armed forces.

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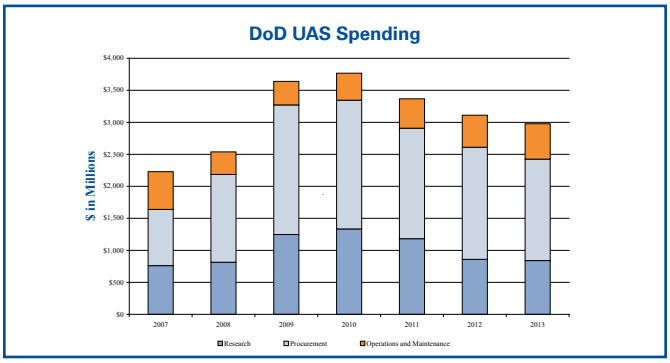
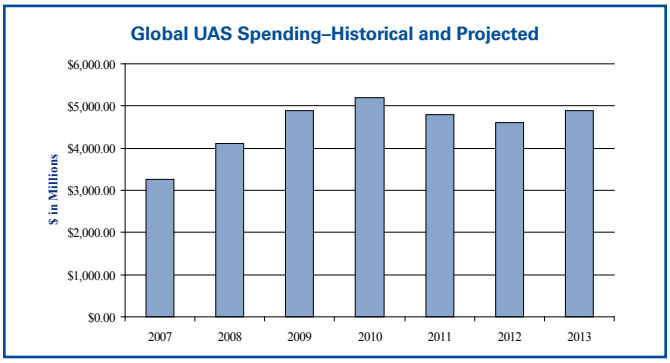
[3] *Washington Technology* , "DoD Requests $5.4B for Unmanned Systems Budget," *June 16, 2009.*

[4] *Defense Systems,* "Unmanned Aircraft Get Smarter," April 2, 2009.

[5] *Aviation Week and Space Technology,* "Autonomous Futures," June 8, 2009.



Source: U.S. DoD 2007 Unmanned Systems Roadmap



Source: Frost and Sullivan, "Unmanned Aerial Systems - A Market Only for Incumbents?" May 5, 2009.

According to the recently released DoD budget, the DoD plans to spend nearly US$5.4 billion in 2010 on unmanned vehicle technology for air, ground, and maritime applications. This budget is an increase of 18.4 percent compared with 2009 military UAV spending, and 37.5 percent over 2008. Approximately US$3.8 billion will be spent on military UAVs in 2010. U.S. UAV spending budgeted for research and procurement is projected to peak in 2010, followed by a slow decrease through 2013.[6] While future spending could outpace forecasts given the U.S. Military's recent rise in interest in unmanned aircrafts, the projection is consistent with the anticipated decrease of the DoD budget in the coming years.

Major Players

The UAV market consists of several small, highly innovative defense technology contractors, as well as several incumbent aerospace giants. However, in recent years, the military's most successful UAV technology, including the very successful Predator (made by General Atomics), in-development Phantom Ray (made by Boeing), and the Global Hawk (made by Northrop Grumman), has not come from any of the usual contractors. Boeing's UAV came from its acquisitions of Insitu and Frontier. The Global Hawk was conceived at Ryan Aeronautical, an acquisition of Northrop Grumman. According to Peter Singer, director of the 21st Century Defense Initiative at the Brookings Institution, the big players are "facing some major issues as homes of innovation." As demand for UAVs grows, the Pentagon is increasingly relying on smaller suppliers that have developed the relatively inexpensive and effective UAV systems. Companies such as General Atomics, the maker of the Predator, are fighting to hold their edge over established, deep-pocketed contractors in what has become one of the military's most critical technologies.

With many of the largest defense contractors struggling to produce comparable combat-ready UAV technology, they have been forced to turn to strategic alliances and acquisitions. A good example of this is Lockheed Martin, the Pentagon's largest contractor by sales, which recently tapped General Atomics to supply the company with Reaper aircrafts for a Navy contract. The other alternative is acquisitions.[7] Last year, Boeing acquired UAV manufacturer Insitu, and in June, folded the company into its newly created unmanned-airborne-systems-division. Other examples include Northrop's acquisition of Ryan Aeronautical and Swift Engineering, Boeing's acquisition of Frontier, Rockwell Collins' acquisition of Athena Technologies, and BAE's acquisition of Advanced Ceramics Research.[8]

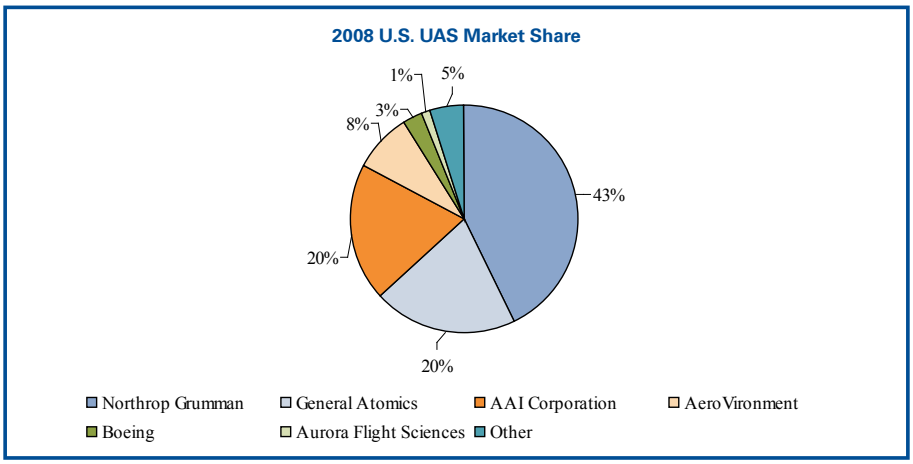
Conclusion

With the DoD's budget for UAVs projected to be at a record high this year, competition will be fierce between incumbent and new industry players fighting for funding and contracts. The UAV market is young and developing, and as more competitors enter the arena, technology in UAVs will continue to expand and arouse public interest. Larger manufacturers will likely acquire smaller companies to enter the market and expand their technologies that will continue the evolution of UAVs.

[6] *Military & Aerospace Electronics*, "Unmanned vehicle spending in the 2010 DOD budget to reach $5.4 billion," May 28, 2009.

[7] The *Wall Street Journal*, "Makers of Military Drones Take Off," August 24, 2009.

[8] *Aviation Week and Space Technology*, "Autonomous Futures" June 8, 2009.



Source: Frost and Sullivan

Select Aerospace & Defense Transactions

- May 1, 2009 – **Goodrich Corp.** (NYSE: GR), a global supplier of systems and services to aerospace, defense, and homeland security markets, has agreed to acquire **Cloud Cap Technology Inc.**, a manufacturer of highly integrated autopilots, payloads, and inertial sensors for the small unmanned aircraft systems market for US$29.1 million.
- June 1, 2009 – **Ceradyne, Inc.** (NASDAQ: CRDN), a manufacturer of technical ceramic products and components for commercial and defense industries, has agreed to acquire the assets related to ballistic combat and noncombat helmets of **Diaphorm Technologies, LLC**, a Salem, New Hampshire based manufacturer of continuously fiber reinforced (CFR) plastic composites for US$19.9 million.
- July 24, 2009 – **TransDigm Group Incorporated** (NYSE: TDG), a manufacturer of engineered aircraft components, has agreed to acquire **Acme Aerospace, Inc.**, a manufacturer of custom batteries and battery control electronic systems for aircraft, for US$40 million. The transaction represents an implied valuation multiple of 2.2x LTM July 2009 revenue.
- August 10, 2009 – **TransDigm Group Incorporated** (NYSE: TDG), a manufacturer of engineered aircraft components, has agreed to acquire certain assets including highly engineered fuel and pneumatic valves and surge suppressors from **Woodward Governor Company** (NASDAQ: WGOV), a manufacturer of energy control systems and components for commercial and military aircraft for approximately US$48 million.
- August 21, 2009 – **Chandler/May, Inc.**, a provider of system integration and tactical product development for various industries, including the UAV industry, has agreed to acquire **AeroMech Engineering Inc.**, a provider of engineering services to the aeronautical, mechanical, and manufacturing industries with a specialization in the UAV market, for an undisclosed amount.
- August 26, 2009 – **Precision Castparts Corp.** (NYSE: PCP), a manufacturer of metal components and products for various industrial markets, has agreed to acquire **Carlton Forge Works**, a producer of rotating and structural components for commercial and military aviation, and **Arcturus Manufacturing Corporation**, a manufacturer of closed die and open die forgings, machined parts, and assemblies for the aviation industry, for $850.0 million.

Source: Capital IQ, September 30, 2009

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