Public Safety's Best Future Weapon May Be Virtually Unseen

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The Command College Futures Study Project is a FUTURES study of a particular emerging issue of relevance to law enforcement. Its purpose is NOT to predict the future; rather, to project a variety of possible scenarios useful for strategic planning in anticipation of the emerging landscape facing policing organizations.

This journal article was created using the futures forecasting process of Command College and its outcomes. Defining the future differs from analyzing the past, because it has not yet happened. In this article, methodologies have been used to discern useful alternatives to enhance the success of planners and leaders in their response to a range of possible future environments.

Managing the future means influencing it—creating, constraining and adapting to emerging trends and events in a way that optimizes the opportunities and minimizes the threats of relevance to the profession.

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Across the United States officials guard our public safety relying primarily on the time-tested tools of surveillance and vigilant patrol. On the near horizon are means by which this crucial work may be changed significantly.

Future police surveillance could come in the form of the humming presence of a High Altitude Long Endurance (HALE) Unmanned Aerial Vehicle (UAV), rather than from cars laden with the smell of stale coffee and fast food wrappers. Instead of protecting critical resources with guards stamping their feet in the damp night air, the job could be completed around the clock by unblinking UAV sensors. The pages that follow will introduce the history of the UAV and consider how the capabilities of unmanned craft can be a viable resource for law enforcement and public safety.

UAV DEFINITION AND HISTORY

The ability of UAVs to provide reliable surveillance with endurance will satisfy many of the mission needs of public safety, particularly law enforcement. Before discussing their use in policing, though, it is useful to look at what they are, and how they have become an integral component of societies waging war, or otherwise seeking an advantage by seeing what might be "just over the horizon."

UAVs are unmanned aircraft being capable of controlled, sustained flight powered by a jet or reciprocating engine. A High Altitude Long Endurance (HALE) UAV is a craft capable of flying at or above 25,000 feet, for a period of 24 hours or longer, and can be operated through remote and autonomous means. Successful military HALE UAV uses have shown them to have capabilities that would help public safety accomplish basic and specialized missions. UAVs have been so adaptable and dynamic in military work that their deployment changed dramatically from its initial uses.

The history of the UAV precedes its recent successes by more than one hundred years. In February 1863, the first legitimate UAV was a hot air balloon whose basket had a hinged floor allowing its explosive contents to be dropped; the craft saw limited use in the American Civil War (Klein & Axelrod, 2002). The surveillance value of UAVs was birthed shortly thereafter. In 1889 a kite and a camera with a long shutter release took hundreds of aerial photographs during the Spanish American War. Rather than being used for intelligence, however, the pictures were sold by the hundreds as souvenirs. The primary use of a UAV in a surveillance role has been sustained since these early days (Dunnigan, 2002).

The first efforts to make UAV technology perform more practically started in 1917. Elmer A. Sperry developed the Aerial Torpedo, which included an auto gyroscope to control its flight (Klein & Axelrod, 2002). Although never used in combat, it flew 50 miles carrying a 300-pound bomb. The most significant improvements to UAVs occurred in the 1940s as the Germans used the V-1 to deliver a 2000-pound warhead over 150 miles (Klein & Axelrod, 2002).

From 1960 to 1975 the US Air Force operated the Ryan Firebee in Southeast Asia. A manned director aircraft guided the unmanned Firebee on radar detection, covert surveillance and psychological operations. In the 1980s the Israelis operated a fiberglass Scout UAV that was integral in eliminating anti-aircraft defenses in the 1982 Bekaa Valley conflict. The Scout provided real-time, 360-degree video surveillance (Klein & Axelrod, 2002).

The US Air Force fielded the General Atomics Predator UAV in the Balkans War in the 1990's, the first use of the Predator system. The vehicle used high definition and infrared cameras and single aperture radar (SAR) in surveillance missions. Soon after the Balkans operation, Predators began being outfitted with missiles, adding an airstrike capability (Klein & Axelrod, 2002). The application of UAVs in military operations has steadily grown ever since.

In 1997, USAF Major R. Nolan, introduced the viability of unmanned military aviation, his work was a seminal point in advocating the UAV as a military asset (Nolan, R., Major USAF 1997). This work proposed UAVs as a force multiplier - a resource that improves the effectiveness and productivity of other assets - not constrained by the limits of human operators. He suggested that a reasonable starting point for the development of military UAVs was to use them when human pilots were not needed. These missions would include passive, monotonous reconnaissance in dangerous environments. The Predator HALE UAVs in Bosnia operated at 25,000 feet for 50 hours, proving the endurance and adaptability of UAVs (Nolan, R., Major USAF 1997).

As UAVs became more relevant in military applications, the request for their use grew. In short order, UAVs were being fitted with live video feed capability, a variety of weapons, sensors and search / rescue supporting capabilities. The growth of UAV use in the military helps bring into closer focus the future introduced by Major Nolan. In fact, a largely pilotless Air Force is on the cusp of becoming a reality (Bone & Bolkcom 2003). Such an unmanned emphasis in the military makes forecasts for a growing civilian UAV market almost inevitable.

MILITARY SUCCESSES SUGGEST CIVILIAN USES

Civilian agencies have a variety of dull, dangerous and dirty missions that have been effectively done by UAVs in military settings. Consider the role they might play in disaster response, law enforcement and homeland security surveillance and research applications. The UAV characteristics of payload capacity, an ability to carry varied sensors and gear, and the ability to fly high above routine commercial air traffic all lend credence to their suitability for a variety of civilian missions (Sarris 2001).

Aviation industry advisors, Forecast International estimate civil UAV applications will see massive growth by 2010. The FAA Forecast Conference 2008 reported the UAV market is expected to be worth $55 billion dollars annually by 2017. UAV systems are expected to be the largest growth area in aviation. This report reinforces the opinion that civil UAV markets will grow significantly and will soon challenge the military as the leader in this industry (Cabanya 2008). The aviation consultants, Teal Group, estimate the UAV market will double by 2016 to a worth of $8.3 billion dollars (Aerospace Daily and Defense Report, 2006). According to the report Commercial Use of Unmanned Aerial Vehicles, law enforcement is expected to be an arena of particular interest for UAV use (Sarris 2001).

Public Safety UAV Uses

A HALE UAV with its high operating altitude, sensor payload capacity and operational endurance can cruise a constant circuit overhead. The craft can be outfitted with a variety of sensor payloads designed for different purposes. One sensor package could constantly monitor specific homeland security targets, while another could survey law enforcement hot spots or other locations. The range and endurance of the craft would allow it to provide reliable surveillance over spaces as large as an urban area such as Los Angeles County. Interestingly, UAVs have already had an influence in public safety because of their versatility.

In "Trends Now Shaping The Future of Policing", Dr. M. Cetron said law enforcement usually "piggy-backs" on much of the cutting-edge R&D projects developed for military or intelligence use, as the needs are similar, and the technology can be easily adapted for civilian use (Cetron 2008). Surveillance, a successful UAV application, is a task naturally useful to law enforcement. In a government report, Unmanned Aerial Vehicles End-to-End Support Considerations, UAVs are credited with bringing critical endurance capability to surveillance tasks (Drew, J., Shaver, R., etc., 2005). The Predator HALE UAV, for instance, can help law enforcement conduct their surveillances with great endurance.

Predators have already been used to support public safety and disaster missions. Using Single Aperture Radar (SAR) sensors, Predators identified illegal entry along the U.S. southwest border for U.S. Customs and Border Protection (CBP). Several remote and rugged areas never before surveilled could be watched regularly by the UAV. More than 3900 arrests have been made through the use of the CBP HALE UAV (Kasitz 2007). In 1997 Japanese authorities used unmanned craft to monitor the dangerous environment and developments of the Mt. Usu volcanic eruption. The information developed by the craft helped direct response to the disaster (Yamaha 2004). According to Survey of UAV Applications in Civil Markets, this type of UAV usage is expected to grow as the civil UAV industry develops (Sarris 2001).

Benefits of UAVs to Public Safety

HALE UAV assets bring capabilities that would assist law enforcement. Most noted amongst their advantages are:

Conducting Various Missions: UAVs use optical sensors, infrared sensors, laser identifiers, chemical / biological sensors and global positioning capabilities to conduct their missions. These implements have successfully assisted law enforcement in the past in UAV and manned flight applications. The adaptability of the UAV makes it a functional resource for the many categories of law enforcement missions. For instance, using Single Aperture Radar (SAR) sensors, U.S. Customs and Border Protection (CBP) Predator HALE UAVs identified illegal entry along the Southwest U.S. border (Kasitz 2007).

Achieving Missions Simultaneously: A HALE UAV can be deployed for as long as fifty hours. These craft can deploy sensors along a region-sweeping flight plan. During flight the various programmed sensor packages would conduct surveillance of homeland security targets, law enforcement hot spots and conduct even routine duties such as traffic monitoring. In the Civil UAV Capability Assessment UAVs are acknowledged to have the capability to be operated autonomously and also be able to be redirected to specific tasks should developments occur requiring their reassignment (Cox, Nagy, Skoog, Somers, & Warner 2004).

Adding Productivity to Sensors: HALE UAVs have deployed optical, chemical / biological scanning, infrared sensors and communications system links in diverse military and civilian applications. Optical cameras, face recognition systems and license plate readers, all capable of being deployed on a UAV, are already used in public safety operations in static, vehicle-borne and manned airborne modes. For instance, New York police now have a helicopter surveillance system which uses license plate readers and facial recognition systems for public safety and homeland security operations (Associated Press, 2008).

Public Safety Force Multiplier: Significant manmade or natural events can cause serious consequences including exhausting the safety resources of an entire region. A HALE UAV is a force multiplier that increases the effectiveness of resources in the field (Nolan, R. Major USAF, 1997). For instance, when evidence of illegal entry is noticed on the border U.S. Customs and Border Protection, Predator UAVs scan the area, locate the violators and the path they traveled, then using global positioning technology and lasers they efficiently guide authorities to arrest them (Kasitz 2007). The availability of HALE UAV resources for extended periods gives them an edge over manned aircraft such as the helicopters and fixed wing craft in use in many agencies today.

When the endurance limitations of conventional air support are compared to the HALE UAV, the value of the application of unmanned systems can be seen. UAV endurance increases the productivity and availability of the resource as compared to the limitations of manned flight resources. Review of recent western wildfires revealed the limited availability and capacity of manned resources seriously reduced the efficient mitigation of these incidents (Edds 2008). Using unmanned craft, though, will require significant preparation and planning before they are prepared to meet safe civilian aviation guidelines. Certainly, safe flight operations will be a key issue in deploying UAVs in domestic airspace.

CHALLENGES IN PUBLIC SAFETY UAV APPLICATIONS

The unmanned nature of the UAV is both a strength and weakness. Unlike military applications overseas, civil UAVs in the National Airspace (NAS) require authorization from the Federal Aviation Administration (FAA) as the "single manager of the NAS" (Federal Aviation Act 1958). The FAA controls access to and the safety of the NAS. To date only research and homeland security UAVs have been cleared to use domestic airspace. Wider access to domestic airspace will require significant planning with federal and aviation authorities and remains the most critical aspect of developing a UAV program. Similar cooperative efforts on gaining UAV access have shown promise.

In 2004, NASA, civil and military UAV users, along with the aviation industry, established the "Access 5" project to develop a system to meet FAA and aviation industry safety demands for domestic airspace. The project made significant headway until its primary funding authority under NASA was exhausted in 2006 when that agency refocused its efforts away from regulatory issues (Crosby 2004).

The goal of Access 5 was to achieve safety standards equal to manned flight. Cooperative efforts such as Access 5, which follow the more successful European strategy of the European Aerospace Safety Agency (EASA), are needed to develop UAV systems in domestic airspace. The Access 5 effort offers a model to gain access to domestic airspace that attends to the operational concerns of the aviation industry and FAA. The model based on Access 5 is not currently being pursued however; the concept had the support of many parties interested in civil UAV use as it made progress in its work. It is likely that a renewed, organized effort to access domestic airspace - sanctioned by Federal, State and local authorities and key aviation interests - would rally support from all UAV aviation interests (UAV MarketSpace).

The FAA has come under pressure from the aviation industry and law enforcement organizations for delaying decisions on UAV access applications. National Defense magazine further states the FAA approval process is one of the reasons US UAV use lags behind European users (Magnuson 2007). The NDIA Business and Technology Magazine, though, reported in 2008 that civilian UAV access will be authorized in the next 5 years. General Atomics Aeronautical Systems, makers of the Predator UAV, believes UAVs are safe to fly domestically; however, they also state they "believe the FAA is just a little slow" (Peck 2008).

Scientists, engineers and technology marketing experts believe the sheer size of the UAV industry and public demand for UAV development will motivate swifter action by the FAA. This demand driven pressure is evidenced by the fact that applications to the FAA for clearances to test public and private UAVs increased by 300% in 2005 as compared to 2004 (Jewell 2001). This accumulated interest in UAVs guarantees that crowded domestic airspace will be even more heavily traveled, this development will add to the complexity of gaining access to US domestic airspace.

COST AND TRADE OFFS WITH MANNED AND UNMANNED RESCOURCES

HALE UAV systems are expensive; a single system can cost $20 million dollars for the craft and ground/command support. The limited budgets of smaller local government would be challenged by such a financial burden. It seems logical, given the cost and mission capacity of HALE UAVs, that they would be more appropriate for use by a large law enforcement agency, or a regional consortium of public safety interests. In comparison, the costs of operations and staffing for conventional law enforcement air operations are also costly and have significant operational limitations.

Manned air support is the system in use that most closely compares to what a HALE UAV has to offer. Traditional law enforcement air support for even a smaller urban region with a population of one million can easily cost $1 million dollars a year just to contract for the services for a helicopter program (Los Angeles County Sheriffs Department 2000). New York police have a helicopter-borne surveillance system which uses sensors, facial recognition and license plate readers to patrol the city and its sensitive homeland security targets. The fully equipped helicopter alone carries the $10 million dollar price tag (Associated Press, 2008). Even costly manned systems are limited in their operation, especially in the endurance of the flight crew, fuel supply and the risk to the crew from weather and other dangerous environments. A HALE UAV is smaller, consumes less fuel, relies on no crew, is effective in virtually all weather conditions and can be deployed for up to fifty-hour missions. HALE UAV deployment is a more efficient a mode of deploying sensor technology than manned aircraft, in part because UAV flight endurance and operating altitudes are greater. The higher costs of HALE UAV operation should also not be considered to be an unchangeable state.

Many contributors to the discussion of civilian UAVs, including Unmanned Aerial Systems, Inc., mention the innovation and entrepreneurship of the civilian aviation industry will help drive the cost of UAVs down (Cox, Nagy, Skoog, Somers, & Warner 2004). Component miniaturization and other system refinements are also forecast to diminish the cost of UAV technology (Cabanya 2005). As with other new technologies it is expected cost will diminish and funding streams will appear as this resource becomes more mainstream and improvements to the system are developed.

CONCLUSION

The history of the development and success of HALE UAVs strongly supports their value to public safety, particularly law enforcement. Although there are challenges in meeting the safety standards for operation in domestic airspace, the aviation industry and the FAA asserts UAV technology is within five years of approval for domestic flight. There is a sense in the aviation community that advances in technology will make the presence of UAVs in domestic airspace inevitable. Early efforts to gain access to domestic airspace by the Access 5 consortium led to the development of a plan to help aviation industry and aviation authorities meet the FAA safety standards.

Based on the documented effectiveness of UAVs and their adaptability to public safety missions, it is recommended that law enforcement development a HALE UAV program intended to service an urban county sized region. The program will help to effectively and efficiently meet the modern community safety and homeland security needs of the region it services. Such a program would also influence other public safety efforts to exploit and further develop UAV technology. Heeding the advice of Admiral Hyman Rickover, the father of the Nuclear Navy, "Good ideas and innovations must be driven into existence by courageous patience." The HALE

UAV will emerge as one of our tools as long as we have both the virtue of patience and courage to see it happen.

ENDNOTES

Klein, L. & Axelrod, D. (2002) NOVA, Spies That Fly
http://www.pbs.org/wgbh/nove/spiesthatfly/uavs

Dunnigan, J. (2002) How to Make War, A Comprehensive Guide to Modern Warfare in the 21st Century

Nolan, R., Major (1997) The Pilotless Air Force? A Look at Replacing Human Operators with Advanced Technology

Bone, E. and Bolkcom, C. (2003) Report for Congress, Unmanned Aerial Vehicles: Background and Issues for Congress, April 25, 2003

Sarris, Z. (2001) Survey of UAV Applications in Civil Markets, June 2001

Cabanya, R. (2008) Proceedings from the 30th Annual FAA Forecast Conference, Unmanned Aerial Systems, Washington D.C.

Staff Writer (2008) Aerospace Daily and Defense Report

Cetron M., Dr. (2008) 55 Trends Now Shaping the Future of Policing, The Proteus Trends Series, Volume I, Issue I

Drew, J. Shaver, R., Lynch, K., Amouzegar, M. &Snyder, D. (2005) Unmanned Aerial Vehicles: End-To-End Support Considerations, Rand Project Air Force 2005

Kasitz, S. (2007) United States Customs and Border Protection, press release

Aeronautics Operations, Yamaha (2003) Civilian UAV Uses in Japan and Related Safety and Certification

Cox, Nagy, Skoog, Somers and Warner (2004) Civil UAV Capability Assessment

Associated Press (2008) Unmarked Chopper Patrols New York City From Above, May 28, 2008

Edds, K. (2008, March 28) Lessons from the loss. Orange County Register, p. 3

FAA Act (1958)

Crosby, D. (2004) Access 5 Project Overview, UAVS in the Air Traffic Control System, Air Traffic Controllers Association Conference

UAV MarketSpace (2006) Website Report

Magnusson S. (2007) National Defense, FAA Takes Slow Path to Domestic UAV Approval

Peck, S. (2008) NDIA Business and Technology Magazine

Jewell (2001) Commercial Use of UAVs

Los Angeles County Sheriffs Department (2000) South Bay Regional Sir Support

Hanson, K. (2008) Long Beach Press Telegram, Business, P. 3

Haverman, J. & Shatz, H. (June 2004) Protecting the Nation's Seaports: Balancing Security and Costs http//www.ppic.org/main/publication.asp