

Border Security and Unmanned Aerial Vehicles

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Summary

The use of Unmanned Aerial Vehicles (UAVs) to improve border security is a technique that has gained the attention of Congress. This report examines the strengths and limitations of deploying UAVs along the United States' borders and related issues for Congress. This report is not intended to provide in-depth information regarding the technical or military capabilities of UAVs, but rather to discuss their application in maintaining border security.

Background

Border security has long been recognized as a priority by the U.S. Congress. The northern border separating the mainland United States and Canada is 4,121 miles long, and consists of 430 official and unofficial ports of entry.¹ The expansive nature of the border and the possibility of entry through unpopulated regions make the border difficult to patrol. In July 2003, U.S. Customs and Border Protection (CBP) Commissioner Robert Bonner announced that an additional 375 border patrol agents would be re-assigned to the U.S. border with Canada. This increase brought the number of agents deployed on this border to 1,000.² Commissioner Bonner also noted that CBP's border agents had "the front line responsibility for detecting terrorists and terrorist weapons."³

The southern border separating the United States and Mexico is 2,062 miles long, and consists of thirty ports of entry and "innumerable unofficial crossings."⁴ In contrast to the United States' northern border, however, as of January 2003, more than 10,000 border patrol agents were stationed on the southern border. Despite this larger presence, covering a much shorter border, illegal border crossings and significant drug smuggling activities occur frequently.

In addition to being patrolled by border patrol agents, the borders are monitored and protected by video cameras, ground sensors, physical barriers, land vehicles, and manned aircraft. The diverse nature of U.S. border defense strategies is challenged by an equally diverse array of threats, ranging from terrorists to drug smugglers, arms dealers, and human traffickers. Past difficulties in securing the nation's borders, com-

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¹ See *CIA World Factbook*, at www.cia.gov/cia/publications/factbook/geos/ca.html#Geo.

² U.S. Customs and Border Protection, Office of the Commissioner, "CBP Assigns Additional Border Patrol Agents to Increase Northern Border Security," press release, 2 July 2003.

³ *Ibid.*

⁴ U.S. Congress, House Committee on Government Reform, *Federal Law Enforcement at the Borders and Ports of Entry: Challenges and Solutions*, 107th Congress, 2nd sess., H.Rept. 107294 (July 2002), 19.

bined with fears that terrorists could exploit existing security vulnerabilities by surreptitiously crossing the borders, has prompted Congress to call on the Department of Homeland Security (DHS) to examine the potential use of Unmanned Aerial Vehicles (UAVs).

UAVs are also known as drones, or remotely piloted vehicles (RPVs).⁵ The Department of Defense defines a UAV as a powered aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry lethal or nonlethal payloads.⁶ UAVs have played important roles in recent conflicts in Bosnia, Kosovo, Afghanistan, Pakistan, and both Gulf Wars.⁷ Historically, UAVs have been utilized in various military settings outside of U.S. borders. For example, during Vietnam and the recent crises in the Balkans, UAVs provided real-time reconnaissance, surveillance, target acquisition, search and rescue services, and battle damage assessments.

UAV technology has also been applied domestically. The NASA-sponsored Environmental Research Aircraft and Sensor Technology (ERAST) program has produced civilian UAVs to monitor pollution and measure ozone levels.⁸ Academic institutions have also been active in exploring civilian uses for UAVs. The Massachusetts Institute of Technology (MIT) is involved in developing Global Positioning Systems (GPS) and video camera guidance systems for locating and identifying toxic substances.⁹ The Department of Energy has also announced that it will test UAVs outfitted with radiation sensors to detect potential nuclear reactor accidents.¹⁰

On 12 November 2003, Congress agreed to the Department of Defense (DoD) Authorization Conference Report (H.R. 1588), which became P.L. 108-354 on 24 November 2003. Section 1034 of the DoD Authorization Act requires the president to issue a report "on the use of unmanned aerial vehicles for support of homeland security missions." UAVs were recently tested for potential domestic application on the U.S.-Mexican border. UAV demonstrations conducted by various commercial companies at Fort Huachuca and Gila Bend, Arizona on behalf of the Department of Homeland Se-

⁵ It is important to note the distinction between drones and RPVs. Both drones and RPVs are pilotless, but drones are programmed for autonomous flight, whereas a ground control operator controls the flight pattern of an RPV.

⁶ United States Department of Defense, *Dictionary of Military and Associated Terms*, Joint Publication 1-02 (Washington, D.C.: U.S. Department of Defense, April 2001), 557.

⁷ For a discussion regarding the military application of UAVs, see Elizabeth Bone and Christopher Bolkcom, *Unmanned Aerial Vehicles: Background and Issues for Congress*, CRS Report RL31872 (Washington, D.C.: Congressional Research Service, Library of Congress, 2003). For use of this technology by the Navy, see Ronald O'Rourke, *Unmanned Vehicles for U.S. Naval Forces: Background and Issues for Congress*, CRS Report RS21294 (Washington, D.C.: Congressional Research Service, Library of Congress, 2005).

⁸ More information regarding ERAST can be located at www.eraст.com.

⁹ Hugh McDaid and David Oliver, *Smart Weapons* (New York: Barnes and Nobles Books, 1997), 9.

¹⁰ Jefferson Morris, "GoldenEye UAV to perform flight demo for DOE," *Aerospace Daily* (5 December 2003).

curity's Customs and Border Protection (CBP) Bureau have prompted various questions regarding their potential use within the United States. Shortly after the Arizona UAV demonstrations, DHS acknowledged that one model of UAV, the Predator B, would be used in Operation Safeguard, an experimental law enforcement program that will conduct missions along the U.S.-Mexican border.¹¹ P.L. 108-90, on appropriations for the Department of Homeland Security, provides USD 35.2 million to establish a Northern Border Airwing, of which USD 12.8 million will be available for aircraft procurement. In earmarking these funds, Congress supported functional and organizational air and marine interdiction (AMI) and modernization efforts. Congress also assigned the DHS Under-secretary of Border and Transportation Security to devise a report outlining operational plans by which the Air and Marine Operations Center (AMOC) would eliminate surveillance gaps affecting the northern border and western United States.

Benefits and Limitations of UAVs

One potential benefit of UAVs is that they could fill a void in current border surveillance. In particular, the unique technical capabilities of UAVs could improve coverage along remote sections of the United States' borders. Electro-optical identification technology is advanced enough that it can identify a potentially hostile target the size of a milk carton from an altitude of 60,000 feet.¹² UAVs can also provide precise and real-time imagery to a ground control operator, who would then disseminate that information so that informed decisions regarding the deployment of border patrol agents on the ground can be made quickly.

Another benefit of the UAV system is what is known as its loiter capabilities. The Predator B used in Operation Safeguard can fly for more than thirty hours without having to refuel.¹³ The UAV's ability to loiter for prolonged periods of time has important operational advantages over manned aircraft. The longer flight times of UAVs mean that they are able to provide sustained coverage over a previously exposed area, which may improve border security.

UAVs are less expensive than other manned aircraft used on the borders. The unit cost of UAVs varies widely. The Shadow UAV costs USD 350,000, while the Predator costs USD 4.5 million.¹⁴ In contrast, the unit cost of a P-3 manned aircraft used by U.S. Immigration and Customs Enforcement is USD 36 million. Black Hawk helicopters, which are frequently used on border patrol missions, cost USD 8.6 million per

¹¹ The Department of Homeland Security's Bureau of Immigration and Customs Enforcement (ICE) evaluated the Predator B used during Operation Safeguard, which began on 29 October 2003 and ended on 12 November 2003. Representatives from the General Atomics Corporation remotely piloted the Predator B during simulated night and daytime border demonstrations.

¹² Peter Hardin, "Eyes in the Skies," *Richmond Times-Dispatch* (30 October 2003), F1.

¹³ For additional information regarding the Predator B's technical capabilities, see the General Atomics website at www.uav.com/products/predator_b_er.html.

¹⁴ See Bone and Bolkom, *Unmanned Aerial Vehicles*.

unit. However, the benefits of the Black Hawk's relative low unit cost are diminished by its lack of endurance. Black Hawks have a maximum flying time of 2 hours and 18 minutes.¹⁵ Consequently, the longer flying time of unmanned aircraft would allow them to patrol the border longer—e.g., for an entire night—while reducing the overall number of missions flown.

The range of UAVs is a significant asset when compared to either border agents on patrol or stationery surveillance equipment. If an illegal border entrant attempts to transit through dense woods or mountainous terrain, UAVs would have a greater chance of tracking the violator with thermal detection sensors than would the stationary video equipment that is often used on the borders. It is important to note, however, that rough terrain and dense foliage can degrade the images produced by a UAV's sensory equipment, and thus limit their effectiveness on certain segments of the border. Another benefit is that the extended range and endurance of UAVs may lessen the burdens on human resources at the borders. During Operation Safeguard, the prototype Predator B RPV was remotely piloted from a ground control station. The safety concerns faced by helicopter pilots on patrol are eliminated when UAVs are used.

Despite the potential benefits of using UAVs for homeland security, various problems encountered in the past may hinder UAV implementation on the border. There are concerns regarding UAVs' high accident rate. Currently, the accident rate for UAVs is 100 times higher than that of manned aircraft.¹⁶ Because UAV technology is still evolving, there is less redundancy built into the operating systems of UAVs than of manned aircraft; until redundant systems are perfected, mishap rates are expected to remain high. Additionally, if control systems fail in a manned aircraft, a well-trained pilot is better positioned to find the source of the problem because of his/her physical proximity. If a UAV encounters a similar system failure, or if a UAV landing is attempted during difficult weather conditions, the ground control pilot is at a disadvantage, because he or she is removed from the event. Unlike a pilot on board an aircraft, the remote pilot would not be able to assess important sensory information such as wind speed, runway conditions, etc.¹⁷

The key goal of Operation Safeguard was to identify potential threats crossing the southern border illegally. The surveillance capabilities of UAVs equipped with only an electro-optical camera and forward looking infrared radar (FLIR) sensor have been limited in the past by poor weather conditions. Cloudy conditions and high humidity climates can distort the imagery produced by electro-optical and FLIR equipment. Although the Predator B is operating primarily in the low-humidity environment of the Southwest, the effects of extreme climatic or atmospheric conditions on its sensors reportedly can be mitigated if DHS decides to outfit the Predator B with a synthetic ap-

¹⁵ Paul Jackson, *Jane's All the World's Aircraft 2003-2004* (Alexandria, VA: Jane's Information Group, 2003), 721–22.

¹⁶ *Ibid.*

¹⁷ Amy Butler, "ACC Officials to Suggest Service Establish Five Predator Squadrons," *Inside the Air Force*, 7 June 2002.

erture radar (SAR) system.¹⁸ These radar systems can produce high-resolution imagery in inclement weather. The ability of SAR to function during adverse weather conditions sets it apart from optical or infrared systems.¹⁹ However, its ability to track moving targets is limited. This limitation can be mitigated by augmenting SAR with moving target indicator (MTI) radar technology. Adding SAR and MTI to the Predator B's platform could significantly enhance its operational capability for border missions. By adding SAR and MTI to the UAV platform, however, the costs of using UAVs on the border would increase.

How UAVs could be integrated into civilian airspace within the United States is a fundamental question that would need to be addressed by the Federal Aviation Administration (FAA) and DHS. Integrating UAVs into civilian airspace so that they can operate safely would require not only the creation of regulatory guidelines by the FAA, but also a variety of technical developments, primarily around safety issues. Currently, the FAA is working on guidelines for integrating UAVs into the national airspace. Although there are no guidelines or regulations for incorporating UAVs into domestic airspace, the FAA has worked closely with government users of UAV technology in developing a certificate of authority (COA) so that portions of airspace can be blocked off for exploratory development or operational testing. A primary concern of the FAA is whether UAVs can operate in already crowded airspace. The challenge, according to FAA spokesman William Shumann, is "to develop vehicles that meet FAA safety requirements if they want to fly in crowded airspace."²⁰ Before UAVs can be introduced into domestic U.S. airspace, the FAA, DHS, and other relevant technology users will need to address collision avoidance, communication, and weather avoidance issues.²¹

Issues for Congress

Congress will likely conduct oversight of Operation Safeguard before considering wider implementation of UAV technology. Additionally, the president's report to the Congress in April 2004 on the use of UAVs for support of homeland security missions should be useful to congressional evaluations, especially with respect to the tactical, early warning, and intelligence capabilities of this technology. If implemented, would UAVs simply be used to monitor the borders for illicit activity, or would they be util-

¹⁸ According to General Atomics, the Predator B used during Operation Safeguard was equipped with electro-optical, FLIR, and SAR systems.

¹⁹ For further information about synthetic aperture radar (SAR), see www.sandia.gov/radar/whatis.html. The SAR system used by some Predators is called the LYNX. The LYNX system can provide photographic images of up to four-inch resolution at a maximum altitude of 40 kilometers in fair weather. For more about the LYNX system, see www.ga.com/news/lynx_sar.html.

²⁰ Greta Wodele, "Firms to showcase unmanned planes for Border Patrol," *National Journal's Technology Daily* (11 August 2003).

²¹ In November 2003, the FAA, DoD, NASA, and six private commercial companies launched Access Five, a five-year program to address the safety and technical concerns associated with using UAVs in domestic airspace.

ized in a more sophisticated manner? In the future, could UAV imagery be used to develop intelligence products on patterns and tactics used by illegal entrants?

If Congress concurs that UAVs can fulfill an important homeland security mission, how many UAVs would be needed to patrol the borders? A robust pilot program simultaneously testing multiple UAVs on the borders might be needed in order to ascertain where, how, and whether UAVs should be deployed. Larger-scale testing would provide an opportunity to evaluate whether the technical limitations of UAVs would hinder their utility on the border. In the past, multiple UAVs piloted in close proximity to each other have experienced interference and loss of control between the UAV and the remote pilot. In many cases, such interference led to accidents. An expanded pilot program would provide an opportunity to evaluate UAVs in a more realistic operational setting. Additionally, testing multiple UAVs on the borders could help in establishing parameters under which they could successfully operate.

The use of UAV technology on the northern and southern borders of the United States could potentially act as an important force multiplier by covering previously unpatrolled areas. This comparative advantage, however, may not be so significant when terrorists, like the September 11 hijackers, can enter the country through more easily accessible official ports of entry. Another consideration is how well—and how quickly—the CBP could respond to UAV imagery. Are there enough border patrol resources to investigate all targets identified by UAVs? Would the lack of human resources render high technology like UAVs less effective?

The technical capabilities of UAVs have been tested in a military context, but serious safety and technical issues need to be addressed if the program is to be expanded domestically. Perhaps most importantly, a clearly defined role and action plan for the application of UAV technology to homeland security needs would need to be created. If DHS moves forward with efforts to use UAVs in domestic airspace, both broad and technical issues will arise for congressional consideration. For example, will UAVs be more cost-effective or technically proficient in defending the borders than tethered aerostat radars (TARS), biometrics, more sophisticated ground sensor equipment, or additional border patrol agents? Until these questions are addressed, the utility of UAVs in helping to ensure U.S. border security will remain more speculative than practical.