



Homeland Security: Unmanned Aerial Vehicles and Border Surveillance

Chad C. Haddal

Specialist in Immigration Policy

Jeremiah Gertler

Specialist in Military Aviation

July 8, 2010

Congressional Research Service

7-5700

www.crs.gov

RS21698

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE 08 JUL 2010		2. REPORT TYPE		3. DATES COVERED 00-00-2010 to 00-00-2010	
4. TITLE AND SUBTITLE Homeland Security: Unmanned Aerial Vehicles and Border Surveillance				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Congressional Research Service, Library of Congress, 101 Independence Ave., SE, Washington, DC, 20540-7500				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Summary

Congress has expressed a great deal of interest in using Unmanned Aerial Vehicles (UAVs) to surveil the United States' international land border. U.S. Customs and Border Protection (CBP) utilizes advanced technology to augment its USBP agents' ability to patrol the border, including a fleet of six UAVs. This report examines the strengths and limitations of deploying UAVs along the borders and related issues for Congress.

UAVs come with several costs and benefits. One potential benefit of UAVs is that they could fill a gap in current border surveillance by improving coverage along remote sections of the U.S. borders. Moreover, the range of UAVs is a significant asset when compared to border agents on patrol or stationary surveillance equipment. Yet, despite 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 the high accident rates of UAVs, which have historically been multiple times higher than that of manned aircraft. Inclement weather conditions can also impinge on a UAV's surveillance capability. Also, according to the CBP Inspector General, the costs of operating a UAV are more than double the costs of operating a manned aircraft.

Recent attention has focused on the expanding area of operations for CBP-operated UAVs. On June 23, 2010, the Federal Aviation Administration (FAA) granted a certificate of authorization requested by CBP, clearing the UAV flights along the Texas border and Gulf region. Other requests have reportedly been delayed due to safety concerns, some of which stem from previous incidents. Despite safety concerns, some policymakers continue to call for the increased domestic use of UAVs. The Supplemental Appropriations Bill of FY2010 (H.R. 4899) would include \$32 million for the acquisition of two additional UAVs by CBP.

This report will be updated as events warrant.

Contents

Background	1
Congressional Mandates for the Use of UAVs	2
Benefits and Limitations of UAVs	3
Benefits	3
Limitations.....	4
Other Concerns	5
Issues for Congress	5
Costs vs. Benefits.....	5
UAV Effectiveness	6
Lack of Information	6
Coordination with USBP Agents	6
Safety Concerns	6
Implementation Schedule	7

Contacts

Author Contact Information	7
----------------------------------	---

Background

Within the Department of Homeland Security (DHS), aerial assets are operated by the U.S. Customs and Border Protection's (CBP's) Office of Air & Marine (A&M). CBP utilizes advanced technology to augment its U.S. Border Patrol (USBP) agents' ability to patrol the border. The technologies used include, but are not limited to, sensors, light towers, mobile night vision scopes, remote video surveillance systems, directional listening devices, various database systems, and unmanned aerial vehicles (UAVs). These so-called "force multipliers" allow the USBP to deploy fewer agents in a specific area while maintaining the ability to detect and counter intrusions and are increasingly becoming a part of the USBP's day-to-day operations. Increasingly, DHS has explored the use of UAVs by A&M in support of USBP's mission to augment USBP agents' ability to patrol the border.

There are two different types of UAVs: drones and remotely piloted vehicles (RPVs). Both drones and RPVs are pilotless, but drones are programmed for autonomous flight. RPVs are actively flown—remotely—by a ground control operator. UAVs are defined 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.¹ Both types of UAVs have played key roles in recent conflicts.²

The UAVs utilized by CBP are RPVs, and the current fleet consists of six low-to-medium altitude Predator B UAVs. As of late June 2010, A&M was operating five Predator B UAVs: four from the UAS³ Operations Center in Sierra Vista, AZ, and one from the UAS Operations Center in Grand Forks, ND. One additional UAV was modified with structural, avionics, and communications enhancements that are optimized for maritime operations as part of a congressionally mandated maritime modification program (discussed in the section below).⁴ This program also includes procuring a specifically configured maritime ground control station aimed at exploiting the new maritime surveillance hardware and software.⁵ Once operational testing and evaluation are completed, CBP plans to base the modified UAV—known as "Guardian"—at the Corpus Christi Naval Air Station for flights along the Texas border and in the Gulf region.⁶

The recent UAV modification is part of an ongoing push by some policymakers and CBP to both expand CBP's UAV resources and open additional domestic airspace for UAV operations along

¹ United States Department of Defense, *Dictionary of Military and Associated Terms*, Joint Publication 1-02, April 12, 2001, p. 557.

² Historically, UAVs have been used in various military settings outside of U.S. borders. UAVs have provided reconnaissance, surveillance, target acquisition, search and rescue, and battle damage assessments. In the recent wars in Afghanistan and Iraq, UAVs have been used for surveillance purposes and to attack enemies. The Predator UAV, for example, was armed with anti-tank weapons to attack Taliban and Al Qaeda members. For more information, see CRS Report RL31872, *Unmanned Aerial Vehicles: Background and Issues for Congress*, by Harlan Geer and Christopher Bolkom.

³ "UAS", or Unmanned Aerial System, refers to the UAV combined with the data links, control station, and software needed to fly it.

⁴ Randal C. Archibold, "U.S. Adds Drones To Fight Smuggling," *The New York Times*, December 8, 2009.

⁵ Department of Homeland Security, U.S. Customs and Border Protection, *Fiscal Year 2011 Congressional Justifications: Air and Marine Interdiction*, Washington, DC, February 2, 2010, p. A&M-10.

⁶ Department of Homeland Security, "Secretary Napolitano's Remarks at the Center for Strategic and International Studies: Securing the Border: A Smarter Law Enforcement Approach," press release, June 24, 2010, http://www.dhs.gov/ynews/speeches/sp_1277395237872.shtm.

the border.⁷ On June 23, 2010, the Federal Aviation Administration (FAA) granted a certificate of authorization requested by CBP, clearing the UAV flights along the Texas border and Gulf region. Other requests have reportedly been delayed due to safety concerns, some of which stem from previous incidents.⁸ The National Transportation Safety Board held a forum in 2007 on safety concerns associated with pilotless aircraft after a Predator crashed in Arizona the previous year.⁹ The board concluded the ground operator remotely controlling the plane had inadvertently cut off the plane's fuel.¹⁰ Additionally, the FAA and CBP grounded flights of UAVs for six days in June 2010 following a communications failure with a UAV flying over Texas. In response to this incident CBP, with the FAA's cooperation, conducted a safety review and provided UAV operators with additional training.¹¹ Despite safety concerns raised by such incidents, some policymakers continue to call for the increased domestic use of UAVs.

Congressional Mandates for the Use of UAVs

Congress has directed DHS to study the feasibility of using UAVs and to implement the technology to surveil the border on numerous occasions. In the 108th Congress, the Intelligence Reform and Terrorism Prevention Act (P.L. 108-458) included provisions calling for a pilot program to study the use of these technologies, including UAVs, along the northern border. The law also required DHS to present a plan within six months of enactment to comprehensively monitor the southwest border with UAVs, and to implement the plan as a pilot program as soon as funds are appropriated for that purpose.¹² The 2003 DOD Authorization Act (P.L. 108-136) required the President to issue a report "on the use of unmanned aerial vehicles for support of homeland security missions." In the 109th Congress, the conference report to the FY2007 DHS Appropriations Act (P.L. 109-295) urged DHS to work with the Federal Aviation Administration (FAA) to implement a pilot program for the use of UAVs to surveil the northern border.¹³

⁷ Outside CBP, UAVs have also been used by other agencies in domestic settings. The NASA-sponsored Environmental Research Aircraft and Sensor Technology (ERAST) program has produced civilian UAVs to monitor pollution and measure ozone levels. The Massachusetts Institute of Technology (MIT) has been involved in developing Global Positioning Systems (GPS) and video camera guidance for using UAVs to locate and identify toxic substances (Hugh McDaid, *Smart Weapons* (New York: Barnes and Nobles Books, 1997), p. 9.). Lastly, the Department of Energy recently announced in 2003 that it would test UAVs outfitted with radiation sensors to detect potential nuclear reactor accidents (Jefferson Morris, "GoldenEye UAV to perform flight demo for DOE," *Aerospace Daily*, December 5, 2003.).

⁸ Joan Lowy, "Drones Spur Debate: FAA is Under Pressure to Open U.S. Skies to Pilotless Planes," *The Associated Press*, June 27, 2010.

⁹ A Predator B UAV model was used as part of the Arizona Border Control Initiative, a multi-disciplinary initiative that seeks to coordinate federal, state, and local authorities to control the Arizona border, until it was destroyed in a crash on April 25, 2006. Congress required DHS to report on its findings related to this crash and other UAV mishaps by January 23, 2007, in the conference report to P.L. 109-295.

¹⁰ National Transportation Safety Board, *Brief of Aviation Accident: Unmanned Aircraft Crash Near Nogales International Airport Nogales, Arizona, April 25, 2006*, NTSB/AAB-07/, October 16, 2007, <http://www.nts.gov/Publictn/2007/AAB07.htm>.

¹¹ Noah Shachtman, "Border Drone Flights Suspended After Comms Breakdown," *Wired*, online edition, June 18, 2010.

¹² P.L. 108-458, sec. 5101-5104 and sec. 5201.

¹³ U.S. Congress, Conference Committees, *Making Appropriations for the Department of Homeland Security for the Fiscal Year Ending September 30, 2007, and for Other Purposes*, 109th Cong., 2nd sess., H.Rept. 109-699, p. 131.

The FY2006 DHS Appropriations Act (P.L. 108-90) provided \$35.2 million to establish a Northern Border air wing and tasked 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. The act also provided \$10 million for the use of UAVs. P.L. 108-334, the FY2006 Homeland Security Appropriations Act, provided another \$10 million for UAVs in border security. P.L. 109-295 provided \$20 million in FY2007 for DHS's use of UAVs. P.L. 110-161 provided \$14.7 million in FY2008 for the operation and maintenance of UAVs. In FY2009, Congress did not specify the amount of funding A&M should put toward UAVs. The Supplemental Appropriations Bill of FY2010 (H.R. 4899) would include \$32 million for the acquisition of two additional UAVs by A&M.

In response to these congressional mandates, DHS has tested and used UAVs to surveil the U.S.-Mexican border since June 2004 in certain border sectors. The UAV demonstrations conducted by various commercial companies at Fort Huachuca and Gila Bend, AZ, on behalf of CBP have prompted various questions regarding their potential use within the United States that will be addressed subsequently. The FY2008 Consolidated Appropriations Act (P.L. 110-161) directed DHS to explore the use of UAVs in the marine environment in addition to the border, and appropriated \$15 million for DHS's UAV program, resulting in the modified "Guardian" Predator B UAV. Additionally, the DHS conference report to the FY2008 Act directed DHS to work with other federal agencies, including the FAA, to "evaluate the appropriateness of an FAA exemption for small scale" UAV technology.

Benefits and Limitations of UAVs

Benefits

One potential benefit of UAVs is that they could fill a gap in current border surveillance by improving coverage along remote sections of the U.S. borders. Electro-Optical (EO) sensors (cameras) can identify an object the size of a milk carton from an altitude of 60,000 feet.¹⁴ UAVs also can 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 can be made quickly. Additionally, the Predator B used along the southern border can fly for more than 30 hours without having to refuel, compared with a helicopter's average flight time of just over 2 hours. The ability of UAVs to loiter for prolonged periods of time has important operational advantages over manned aircraft. The longer flight times of UAVs means that sustained coverage over a previously exposed area may improve border security.

The range of UAVs is a significant asset when compared to border agents on patrol or stationary 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 the stationary video equipment which 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 at the borders. Nevertheless, the extended range and endurance of UAVs may lessen the burdens on human resources at the

¹⁴ Peter Hardin, "Eyes in the Skies," *Richmond Times-Dispatch*, October 30, 2003, p. F1.

borders. Also, UAV accidents do not risk the lives of pilots, as do the helicopters that currently patrol U.S. borders.

Limitations

Despite potential benefits of using UAVs for homeland security, various problems encountered in the past may hinder UAV implementation on the border. According to a 2003 report, there have been concerns regarding the high accident rate of UAVs, which can be multiple times higher than that of manned aircraft.¹⁵ Because UAV technology is still evolving, there is less redundancy built into the operating system of UAVs than of manned aircraft and 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 encountered a similar system failure, or if a UAV landing was attempted during difficult weather conditions, the ground control pilot would be at a disadvantage because he or she is removed from the event. Unlike a manned pilot, the remote pilot would not be able to assess important sensory information such as wind speed.¹⁶

Inclement weather conditions can also impinge on a UAV's surveillance capability, especially UAVs equipped with only an EO camera and Forward Looking Infrared Radar (FLIR), because cloudy conditions and high humidity climates can distort the imagery produced by EO and FLIR equipment. Although the Predator B is operating 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 aperture radar (SAR) system¹⁷ and a moving target indicator (MTI) radar. Adding SAR and MTI to the Predator B's platform could significantly enhance its operational capability for border missions. However, adding SAR and MTI to the UAV platform would increase the costs associated with using UAVs on the border.

According to the CBP Inspector General, the costs of operating a UAV are more than double the costs of operating a manned aircraft. This is because UAVs require a significant amount of logistical support and specialized operator and maintenance training. Operating one UAV requires a crew of up to 20 support personnel. Additionally, the use of UAVs has resulted in fewer alien apprehensions per flight hour than the use of manned aircraft.¹⁸ The high comparative costs of operating a UAV may be offset somewhat by their comparatively lower unit costs. The unit cost of UAVs varies widely, from \$350,000 for the Shadow UAV to \$4.5 million for the Predator.¹⁹ In contrast, the unit cost for manned aircraft used along the border varies from \$8.6 million for the CBP Blackhawk helicopters to \$36 million for Immigration and Custom Enforcement's P-3

¹⁵ Ibid.

¹⁶ Amy Butler, "ACC Officials To Suggest Service Establish Five Predator Squadrons," *Inside the Air Force*, June 7, 2002.

¹⁷ For more information about Synthetic Aperture Radar, see <http://www.sandia.gov/radar/whatis.html>. The Predator's SAR can provide images of up to four-inch resolution at a maximum altitude of 40 kilometers in fair weather.

¹⁸ Department of Homeland Security, Office of the Inspector General, *A Review of Remote Surveillance Technology Along U.S. Land Borders*, OIG-16-15, December 2005.

¹⁹ CRS Report RL31872, *Unmanned Aerial Vehicles: Background and Issues for Congress*, by Harlan Geer and Christopher Bolcom.

airplanes. However, the benefit of the Blackhawk's relative low unit cost is offset by its lack of endurance, given its maximum flight time of 2 hours and 18 minutes.²⁰

Other Concerns

Lastly, how UAVs could be integrated into civilian airspace within the United States is a fundamental question being addressed by the FAA, DHS, and the Department of Defense (DOD). Integrating UAVs into civilian airspace so that they could operate safely would require not only the creation of regulatory guidelines by the FAA but also technical developments. The FAA requires that all aircraft operating in U.S. airspace have the ability to detect and avoid other aircraft. For UAVs, this has meant that an operator at the Air and Marine Operations Center (AMOC) must be dedicated to each UAV that is flying.²¹ Additionally, the FAA has required that UAV operators be licensed pilots. The FAA currently is working on guidelines for integrating UAVs into the national air space (NAS) and has deployed a representative to AMOC to liaise with DHS on a variety of issues, including the use of UAVs.²² Although there are no guidelines or regulations for incorporating UAVs into the NAS, the FAA has worked closely with government users of UAV technology in developing a certificate of authority (COA) so NAS 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. Before UAVs can be introduced into national airspace, the FAA, DHS, and other relevant users will need to address collision-avoidance, communication, and weather avoidance issues.²³

Issues for Congress

While Congress has demonstrated consistent support for the concept of using UAVs in border security, many questions remain regarding their practical employment.

Costs vs. Benefits

As noted, the cost comparison between UAVs and manned aircraft is complicated. UAVs are less expensive to procure than manned aircraft but may cost more to operate. Thus, the life cycle cost of UAVs could actually be greater than the life cycle cost of manned aircraft. The disparity in operating the two types of aircraft may be offset by the fact that UAVs can remain in the air more than 10 times longer than the helicopters currently being used by A&M to support the USBP. Further, UAV command and control systems are being developed that can control multiple UAVs simultaneously. When fielded, these new capabilities may change the cost comparison to favor UAVs over manned aircraft.

²⁰ Paul Jackson, *Jane's All the World's Aircraft 2003-2004*, pp. 721-722.

²¹ From a CRS site visit to the Air and Marine Operations Center, August 2005.

²² Testimony of Major General Michael Kostelnik, House Committee on Transportation and Infrastructure, Subcommittee on Aviation, March 29, 2006.

²³ In November 2003, the FAA, DOD, NASA, and six companies launched a five-year program to address the safety and technical concerns associated with using UAVs in national airspace.

UAV Effectiveness

Questions as to the effectiveness of UAVs persist. Although “Homeland Security officials praised the (UAVs) as a safe and important tool that ... has contributed to the seizing of more than 22,000 pounds of marijuana and the apprehension of 5,000 illegal immigrants,” others disagree.²⁴

“Unmanned aircraft serve a very useful role in military combat situations, but are not economical or efficient in civilian law enforcement applications,” said T. J. Bonner, president of the Border Patrol union. “There are a number of other technologies that are capable of providing a greater level of usefulness at a far lower cost.”²⁵

The DHS Inspector General noted that UAVs were less effective, in their limited tests, than manned aircraft in supporting the apprehension of unauthorized aliens.²⁶ In addition, the UAVs were used to assist in the apprehensions of aliens who had already been detected by other means. However, the ability of UAVs to maintain position for over 20 hours represents a significant advantage over manned aircraft; in the future, they may be used to actually detect unauthorized entries as opposed to merely supporting apprehensions of aliens already detected. An issue for Congress could entail whether UAVs are an effective tool for securing the border.

Lack of Information

Testing of UAVs along the border has been limited. A robust program to test multiple UAVs on the borders might ascertain where, how, and whether UAVs should be deployed. Larger scale testing would provide an opportunity to evaluate whether the limitations of UAVs would hinder their utility on the border. In the past, multiple UAVs piloted in close proximity have experienced interference and loss of control between the UAV and the remote pilot. In many cases, interference led to accidents. A possible issue for Congress could include whether testing should be expanded before any decisions are made regarding the wide-scale use of UAVs along the border.

Coordination with USBP Agents

While UAVs may, in the future, be used to detect unauthorized entries, the fact remains that USBP agents must be deployed to apprehend any aliens identified. A possible issue for Congress could entail whether there are enough border patrol resources to investigate all UAV identified targets.

Safety Concerns

The technical capabilities of the UAVs have been tested in a military context, but safety and technical issues need to be addressed if the program is to be expanded domestically. Chief among these issues is the FAA’s concerns about the NAS and whether UAVs can be safely incorporated into the nation’s crowded skies. It has been noted that UAVs suffer accident rates multiple times

²⁴ Randal C. Archibold, “U.S. Adds Drones To Fight Smuggling,” *The New York Times*, December 8, 2009.

²⁵ *Ibid.*

²⁶ Department of Homeland Security, Office of Inspector General, *A Review of Remote Surveillance Technology Along U.S. Land Borders*, OIG-06-15, Washington, DC, December 2005.

higher than manned aircraft. However, in an effort to support the wars in Afghanistan and Iraq, DOD fielded UAVs such as Predator and Global Hawk before their development programs were complete. Thus, the UAV accident rate might be lower if these systems had been allowed to mature under the full development program.

Implementation Schedule

Currently, there is not a timeline for the regular use of UAVs in U.S. airspace—either along the entire U.S. border by CBP or in the interior by other agencies. However, other countries, such as Japan and South Korea have, for many years, used UAVs in a variety of civil roles.²⁷ Israel has certified UAVs for civil use, and European air traffic control authorities plan to have UAVs integrated into civil airspace by 2015.²⁸ A possible issue for Congress could involve whether U.S. aviation authorities should pursue a more aggressive implementation plan for the use of UAVs.

Author Contact Information

Chad C. Haddal
Specialist in Immigration Policy
chaddal@crs.loc.gov, 7-3701

Jeremiah Gertler
Specialist in Military Aviation
jgertler@crs.loc.gov, 7-5107

²⁷ Statement of Christopher Bolkcom, Senate Governmental Affairs Committee, Subcommittee on International Security, Proliferation and Federal Services, June 11, 2002.

²⁸ “EDA Funding Civil UAV Integration Efforts,” *Defense Industry Daily*, February 9, 2010.