

# CRS Report for Congress

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## Homeland Security: Unmanned Aerial Vehicles and Border Surveillance

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### Summary

The use of Unmanned Aerial Vehicles (UAVs) to improve border security is a technique that has garnered congressional attention. This report examines the strengths and limitations of deploying UAVs along the borders and related issues for Congress. This report will be updated as events warrant.

### Background

Border Security has long been recognized as a priority by the 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.<sup>1</sup> The expansive nature 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 reassigned to the northern border. This increase brought the number of border patrol agents to one thousand.<sup>2</sup> Commissioner Bonner also noted that CBP's border agents had, "the front line responsibility for detecting terrorists and terrorist weapons."<sup>3</sup>

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."<sup>4</sup> Unlike the northern border, however, as of January 2003, 10,408 border patrol agents were stationed

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<sup>1</sup> *CIA World Factbook* at [<http://www.cia.gov/cia/publications/factbook/geos/ca.html#Geo>].

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

<sup>3</sup> *Ibid.*

<sup>4</sup> U.S. Congress, House Committee on Government Reform, *Federal Law Enforcement at the Borders and Ports of Entry: Challenges and Solutions*, 107<sup>th</sup> Cong., 2<sup>nd</sup> sess., H.Rept. 107-294, July 2002, p. 19.

on the southern border.<sup>5</sup> Despite this larger presence, illegal border crossings and significant drug smuggling activities occur frequently.

Borders are monitored and protected by border patrol agents, video cameras, ground sensors, physical barriers, land vehicles and manned aircraft. The diverse nature of U.S. border defense 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 borders in conjunction 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).

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.<sup>6</sup> UAVs have played key roles in recent conflicts.<sup>7</sup> Historically, UAVs have been used in various military settings outside of U.S. borders. UAVs 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, but also attack. The Predator UAV, for example, was armed with anti-tank weapons and used to attack Taliban and Al Qaeda members.

UAVs have also been used 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.<sup>8</sup> Academia has 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 for locating and identifying toxic substances.<sup>9</sup> The Department of Energy recently announced that it will test UAVs outfitted with radiation sensors to detect potential nuclear reactor accidents.<sup>10</sup>

On November 12, 2003, Congress agreed to the Department of Defense (DOD) Authorization Conference Report (H.R. 1588) which became P.L. 108-354 on November 24, 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.

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<sup>5</sup> Numerical figure provided by the United States Bureau of Customs and Border Protection.

<sup>6</sup> United States Department of Defense, *Dictionary of Military and Associated Terms*, Joint Publication 1-02, Apr. 12, 2001, p. 557.

<sup>7</sup> See CRS Report RL31872, *Unmanned Aerial Vehicles: Background and Issues for Congress*.

<sup>8</sup> More information regarding ERAST can be located at [<http://www.erast.com>].

<sup>9</sup> Hugh McDaid, *Smart Weapons*, (New York: Barnes and Nobles Books, 1997), p. 9.

<sup>10</sup> Jefferson Morris, “GoldenEye UAV to perform flight demo for DOE,” *Aerospace Daily*, Dec. 5, 2003.

UAV demonstrations conducted by various commercial companies at Fort Huachuca and Gila Bend, Arizona on behalf of the Department of Homeland Security'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.<sup>11</sup> P.L. 108-90 on Appropriations for the Department of Homeland Security provides \$35.2 million to establish a Northern Border airwing, of which \$12.8 million will be available for aircraft procurement. In doing so, Congress supported functional and organizational Air and Marine Interdiction (AMI) and modernization efforts. Congress also 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.

## Benefits and Limitations of UAVs

One potential benefit of UAVs is that they could fill a gap in current border surveillance. In particular, technical capabilities of UAVs could improve 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.<sup>12</sup> UAV's 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.

Another benefit of the UAV system is its loiter capabilities. The Predator B used in Operation Safeguard can fly for more than thirty hours without having to refuel.<sup>13</sup> The UAV's ability 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.

UAVs are less expensive than manned aircraft used for border security. The unit cost of UAVs varies widely. The Shadow UAV costs \$350,000 while the Predator costs \$4.5 million.<sup>14</sup> In contrast, the unit cost of a P-3 manned aircraft used by U.S. Immigration and Customs Enforcement is \$36 million. Blackhawk helicopters which are frequently used on the borders cost \$8.6 million per unit. However, the benefit of the Blackhawk's relative low unit cost is diminished by its lack of endurance. Blackhawks have a

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<sup>11</sup> The Department of Homeland Security's Bureau of Immigration and Customs Enforcement (ICE) evaluated the Predator B used during Operation Safeguard, which began October 29, 2003, and ended November 12, 2003. General Atomics Corp. flew the Predator B during simulated night and daytime border demonstrations.

<sup>12</sup> Peter Hardin, "Eyes in the Skies," *Richmond Times-Dispatch*, Oct. 30, 2003, p. F1.

<sup>13</sup> For additional information regarding the Predator B technical capabilities see the General Atomics website at [[http://www.uav.com/products/predator\\_b\\_er.html](http://www.uav.com/products/predator_b_er.html)].

<sup>14</sup> CRS Report RL31872, *Unmanned Aerial Vehicles: Background and Issues for Congress*.

maximum endurance of 2 hours and 18 minutes.<sup>15</sup> Consequently, UAVs longer dwell time would allow them to patrol the border longer.

The range of UAVs is a significant asset when compared to 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 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 an UAV's sensory equipment and thus limit their effectiveness at the borders. The extended range and endurance of UAVs may lessen the burdens on human resources at the borders. During Operation Safeguard the prototype Predator B was remotely piloted from a ground control station. The safety concerns faced by helicopter pilots on patrol are eliminated when UAVs are used.

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 UAVs high accident rate. Currently, the UAV accident rate is 100 times higher than that of manned aircraft.<sup>16</sup> 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.<sup>17</sup>

The key component of Operation Safeguard was to identify potential threats crossing the southern border illegally. The surveillance capabilities of UAVs equipped with only an E-O 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 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) system.<sup>18</sup> Radars 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.<sup>19</sup>

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<sup>15</sup> Paul Jackson, *Jane's All the World's Aircraft 2003-2004*, (Alexandria, VA: Jane's Information Group, 2003), pp. 721-722.

<sup>16</sup> *Ibid.*

<sup>17</sup> Amy Butler, "ACC Officials To Suggest Service Establish Five Predator Squadrons," *Inside the Air Force*, June 7, 2002.

<sup>18</sup> According to General Atomics, the Predator B used during Operation Safeguard was equipped with E-O, FLIR and SAR.

<sup>19</sup> For further information about Synthetic Aperture Radar (SAR) see the following website at [<http://www.sandia.gov/radar/whatis.html>]. The SAR system used by some Predators is called

However, its ability to track moving targets is limited. This limitation can be mitigated by accompanying 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 could operate safely would require not only the creation of regulatory guidelines by the FAA but also technical developments. Currently, the FAA is working on guidelines for integrating UAVs into the national air space (NAS). 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. 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."<sup>20</sup> 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.<sup>21</sup>

## Issues for Congress

Congress will likely conduct oversight of Operation Safeguard before considering wider implementation of this technology. If implemented, would UAVs simply be used to monitor the border for illicit activity, or would they be utilized 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, and of what type 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 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 interference led to accidents. An expanded pilot program would provide an opportunity to evaluate UAVs under a more realistic operational setting. Additionally,

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<sup>19</sup> (...continued)

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 the following website at [[http://www.ga.com/news/lynx\\_sar.html](http://www.ga.com/news/lynx_sar.html)].

<sup>20</sup> Greta Wodele, "Firms to showcase unmanned planes for Border Patrol," *National Journal's Technology Daily*, Aug. 11, 2003.

<sup>21</sup> In Nov. 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 national airspace.

testing multiple UAVs on the borders could help in establishing parameters under which they could successfully operate.

Should RPVs vs Drones be pursued and deployed for border security? Autonomous drones offer advantages over RPVs, especially in terms of reducing personnel workload and operating costs. However, at this stage of technological development, RPVs can be operated more flexibly than drones, and suffer accidents less frequently.

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

The technical capabilities of the 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 important, a clearly defined role and action plan for the application of UAV technology to homeland security needs would need to be created.

Another set of questions pertains to the schedule for implementing UAVs in border security. Currently, the regular use of UAVs in U.S. airspace appears to be slated for the year 2008.<sup>22</sup> If UAVs are deemed to be useful for border security, some may ask why it will take so long implement this technology. Other countries, such as Japan and South Korea have, for many years, used UAVs in a variety of civil roles.<sup>23</sup> Italy could fly civil UAVs by the end of 2002.<sup>24</sup> Could U.S. aviation authorities pursue a more aggressive implementation plan?

UAVs are likely to be fielded as part of a larger system of border surveillance, not as a solution in and of themselves. Are there potential alternatives to using UAVs in this surveillance system? Aerostats may offer one alternative. Aerostats are helium-filled blimps that don't fly horizontally but are instead tethered to the ground with a cable that provides power. Like UAVs, Aerostats are unmanned and can loiter for long periods of time. Aerostats are already fielded by the Customs Service and by the Army for both civil and military applications. If UAVs are deemed attractive because of low cost, elevated sensor capabilities, and long loiter times, Aerostats may be studied as a platform that might offer advantages in all three of these areas.

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<sup>22</sup> "Robots, Jets Could Share Airspace By 2008," *Los Angeles Times*, May 21, 2004. Rich Tuttle, "Meeting on UAVs in NAS gets good industry, FAA reviews," *Aerospace Daily*, Nov. 24, 2003.

<sup>23</sup> Statement of Christopher Bolkcom, in U.S. Congress, Senate Governmental Affairs Committee, Subcommittee on International Security, Proliferation and Federal Services, June 11, 2002.

<sup>24</sup> Tom Kongton, "Italy Could Fly UAVs in Civil Air by Year End," *ISR Journal.com*, June 14, 2004.