

STATEMENT OF DR. GERVASIO PRADO BEFORE THE COMMITTEE ON  
SCIENCE OF THE U.S. HOUSE OF REPRESENTATIVES

HEARING ON "How Can Technologies Help Secure Our Borders"  
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Good Afternoon, Mr. Chairman and members of the Committee; I am very pleased to have the opportunity to share with you my perspectives on the use of technology to improve the security of our borders.

I am Gervasio Prado, President of SenTech, Inc., a small defense contractor in Stoneham, Massachusetts. My working career spans 35 years spent at various research and development institutions. During the last 20 years I have specialized in the development of Unattended Ground Sensors (UGS), the last thirteen of them at SenTech, the company I founded in 1993. Over the last decade, we have participated in many UGS programs funded by DARPA, the US Army and other agencies. I came to this country with my family from Cuba in 1960. We were able to enter the United States legally and my family's success is a testimony of the opportunities that this country offers to people coming here from all over the world.

I would like to talk about a technology widely used to survey border areas both here and overseas. Unattended Ground Sensors (UGS) are devices that can be placed in remote areas, where they will operate for a long time detecting, processing and transmitting information to military or law enforcement personnel

that can act on that information. This technology has a long history that started during the Vietnam conflict, with a variety of acoustic and seismic devices being developed and deployed along the Ho Chi Minh Trail. After the Gulf War in 1991, there was considerable interest in using UGS to detect and locate mobile missile launchers and other high value targets. In recent years, the emphasis has turned towards the detection and localization of civilian vehicles and personnel. This change in emphasis coincided with the increased need and interest in using sensors along the border as an alternative to expensive physical barriers.

A variety of these types of sensors exist and some are in limited use along the Southwest border of the US. The preferred sensing technologies are passive (sensors that do not emit radiation to detect the targets) because they use less power and are more difficult to detect than active sensors. The technologies employed are acoustic, seismic, imaging – both infrared and visual and passive infrared.

Acoustic sensors are very effective in detecting ground and air vehicles. They are easy to conceal, do not need line of sight to the target and generally have very low power consumption. Their performance is affected by changes in the atmospheric conditions, but generally they will detect most vehicles at several hundred meters and heavy trucks or military vehicles at ranges of one kilometer or more. Acoustic sensors are not very effective at detecting personnel.

Seismic sensors are effective against both vehicles and personnel, although their detection range is more limited than that of acoustic sensors. They can be

completely buried, making them very good for stealthy deployment. Seismic sensors can generally detect a person walking at ranges of 30 to 50 meters. However, their performance will vary greatly from site to site.

Passive Infra-Red Sensors are very effective as trip-line sensors. They are very inexpensive and economical, however they have to be carefully emplaced and are harder to conceal.

Visual Imaging Cameras provide excellent resolution pictures and are very reasonably priced if they are meant to be used during the daytime or twilight hours. In extremely low light conditions Infra-Red Imagers have a definite advantage. Their main drawback is that they are very expensive, although the price of IR cameras with un-cooled detectors has been coming down in the last few years.

At the heart of an Unattended Ground Sensor System there is a capable digital signal or image processor that has the task of extracting the relevant information from the transducer outputs. It is in the programming of this device that the art and science of sensor design is based. Sensors must also communicate their results in a reliable and economical way. Sensors are typically linked in a network to a communications Gateway that is used to concentrate the collected data and transmit it over a long haul link (typically a satellite link). The design of distributed sensor networks has become a very active field of research because of its many military and commercial applications. Distributed sensor networks are certain to find an important role in border surveillance.

The most effective utilization of Unattended Ground Sensors involves the use of multiple sensors of different types in order to exploit the unique capabilities of each. For example: Several seismic sensors can be placed to detect people walking along a trail. These sensors, which can operate with minimal power consumption, will send a signal to a Gateway unit connected to a visual or infrared imager. The imager, which has relatively high power consumption, is only turned on when there is a potential target in its field of view. A built-in image processor on the imager detects the moving target, compresses the picture and hands it over to the Gateway to be sent to the user. Coordinating or fusing the data from sensors with very dissimilar capabilities increases the reliability of the reports, and reduces false alarms. It is important to remember that sensors cannot determine the intent of the targets detected, only their presence, location and direction. In this respect the use of imagers acquires a special importance when trying to allocate limited human resources over an extensive border area.

When we are considering the possibility of large numbers of sensors spread over a large area, the amount of information that can be generated could easily overwhelm the communications links and the personnel monitoring the sensors. The biggest challenges to the design of an Unattended Sensor system are: first to limit the number of false alarms to an extremely low rate; second, to extract and condense the relevant information as much as possible. To achieve these objectives, sensors need to be endowed with as much local signal and image

processing capability as possible to make sure that only the essential information is reaching the user.

In summary, Unattended Ground Sensors is a mature technology that is available to provide surveillance over large areas of our borders and enhances the capability of our law-enforcement agents. We now have to apply our organizational skills to fund, deploy and utilize this technology.

Small companies are often at the cutting edge of technology development. They take risks that larger companies avoid and thus form one of this country's most valuable resources. From our perspective, the Department of Homeland Security can play an important role in furthering the development of new technologies that are being conceived on a regular basis at these small companies.

Some specific suggestions that would further these goals are:

- a) Providing better access to DHS personnel at the operational level in order to get first hand feedback of the utility of new technologies.
- b) Making test and evaluation facilities available to small companies, where they can get access to locations and scenarios that would otherwise be available out of their reach.
- c) Allowing small companies to keep more of the Intellectual Property Rights developed under Government Contracts as a way to stimulate participation in programs of critical national importance.

- d) An increase in the funding allocated to small companies through the use of Broad Agency Announcements, SBIRs, etc., would always be helpful. Equally helpful would be a reduction of earmarked funds and allocation of those funds through open competitive procurements.

I would like to conclude with the observation that securing our borders requires solutions that are well beyond the purely technical. While legal immigrants make a very valuable contribution to our society, illegal entries cause serious socio-economic problem. The flow of undocumented aliens across our southwestern border is driven by the lack of freedom and opportunity in their countries. The irresistible desire to immigrate to our country will only be eliminated when their countries have improved substantially their living standards and political institutions.

Securing our borders against terrorists and criminals involved in the drug trade is also a matter of the greatest urgency. Unfortunately, these individuals have the resources to gain entrance to our country legally as tourists, students or businessmen. Deducing the intent of a person arriving at one of our entry points is a most difficult problem without a purely technical solution. We simply need to remember that most the 9/11 terrorists entered the country with legitimate passports and visas.

Thanks again for the opportunity to share my thoughts with you today.