

**Company Profile:**

Geophysical Survey Systems, Inc. (GSSI), is one of several manufacturers of GPR systems. For the past 32 years, GSSI has designed, manufactured and sold GPR equipment worldwide (over 50% of our sales are exports). There are now a large number of service companies using GPR equipment to non-destructively investigate concrete and the earth. Public safety is a key element in many of these services. GSSI has been a GSA supplier for 18 years and has sold to over twenty-five government agencies including every military branch. The total number of our GPR units sold is relatively low because the average selling price is \$25,000.

**GSSI's Position on the Revision of Part 15 in FCC Rules Regarding Ultra-Wideband Transmission Systems:**

GPR is an important class of Ultra-Wideband (UWB) devices. Without doubt, UWB has great potential for wireless communication and a host of new products for home and business use, at ground level and above. On the other hand, GPR is a mature technology that can now rapidly and easily provide 3D images of what lies beneath the surface. Customers for GPR represent a diverse community, with both government and commercial users, using the equipment in a variety of applications, many of them related to public safety.<sup>1</sup>

The GPR industry is well established and quite sizeable in the United States. It encompasses university research, non-destructive investigation of the earth and concrete by a thousand small companies, quality assurance inspection of our bridges (mandated in NH and VT), key military and government uses and identification of potentially dangerous objects that directly affect the safety of the public (e.g. detection of existing gas pipes before installing new utilities). Also note the U.S. government has sponsored the technology through funding for GPR research and product development for over forty years.

More applications can be listed but clearly GPR technology has a high value to society in the United States and the rest of the world. We mention the 'rest of the world' because the UWB standards set here will surely be followed in many other countries.

Proposed FCC regulations for UWB transmitters would likely put GSSI and other manufacturers and users of GPR out of business – without any basis-in-fact for doing so. There are two important distinctions between GPR and other UWB transmission devices to consider when formulating rules for UWB transmission:

- By definition, GPR looks downward into the earth, water, ice and man-made materials to non-destructively detect anomalies. GPR is not intended for air transmission. GPR manufacturers go to some length to reduce unwanted air transmissions. A typical GPR antenna radiates into the ground 1/1000<sup>th</sup> the power a mobile phone radiates into the air. The range of GPR devices in air is typically a few meters, with power levels dropping off sharply after that distance. At no time in the past 30 years has the FCC recorded any GPR interference with other receivers.

---

<sup>1</sup> A list of U.S. government agency customers plus a list of applications with brief descriptions are included at the end of this document.

- A primary issue behind rule changes concerns the protection of Global Positioning Satellite (GPS) system operations. GPR works well with GPS systems, as evidenced by the fact that for the past ten years GPR manufacturers have sold GPS systems that work in conjunction with their GPR systems.

There have been many responses submitted to the FCC in this matter. We were struck by the comments from Gary R. Olhoeft, PhD of the Colorado School of Mines (March 22, 2001) that support these distinctions and highlight a critical consideration in terms of public safety, particularly in light of last September's events:

The "Recommendations ... ignore the operational and public health and safety realities of deploying such devices, especially in times of emergency response to earthquake, flood, contaminant release, utility disruption, landslide, avalanche, oil spill, building collapse, terrorist attack, mine rescue, and other manmade and natural disasters."

We propose that the FCC treat GPR differently from other UWB devices – because GPR is different from all other forms of wireless communication. Surely reasonable regulatory requirements can be developed which will allow for the development and use of new wireless UWB devices, while protecting current users of the spectrum and enabling the continued growth of the GPR industry.

Specifically, we propose that GPR be considered as a unintentional transmitter in air; therefore, it must conform to the existing emission limits of FCC Rules, Part 15 Class B. Testing should take place on concrete or sand to approximate operating conditions and operator licensing should not be required. GPR manufacturers should be required to provide a certification of compliance from an independent testing laboratory.

In the meantime, the GPR industry and FCC could coordinate an independent testing program to monitor emissions under various operating conditions and ensure there is no GPR interference in the frequency spectrum as new GPR devices are developed.

Otherwise, it would seem quite unreasonable and unjustified to put GPR in a regulatory stranglehold causing GPR manufacturers and users to lose their businesses...and the public to lose an essential, proven tool to assure its safety.

## APPLICATIONS FOR GPR

**ROAD AND BRIDGE:** GPR is being specified to perform large-scale road and bridge surveys to assess asphalt thickness as well as deterioration of the country's aging infrastructure. Because GPR is a rapid, non-destructive technique, evaluation is faster, less expensive and does not interfere with traffic.

**UTILITIES:** GPR is the only non-destructive technology that can identify non-metallic subsurface as well as metallic subsurface utilities. "Hits" into gas, water, sewer and fiber optic lines cause costly damage and present serious safety hazards to work crews and the public.

**CONCRETE STRUCTURES:** No other non-destructive technique can provide such a rapid and accurate assessment of the condition of concrete structures. GPR has been used to find voids under airport runways, corrosion in building and parking structures and damage in historic monuments. GPR detects "clear spots" for drilling between rebar, post-tension cables and other conduits embedded in concrete.

**NUCLEAR PLANT CONSTRUCTION:** GPR has been used to precisely locate rebar in plant walls and floors prior to any drilling or other penetration. Use of GPR has prevented accidental borings into live electrical conduits or rebars in concrete that could compromise the integrity of the construction. A special GPR system will be designed for Chernobyl to locate highly radioactive material in the concrete containment structure.

**HAZARDOUS WASTE:** Over the past 20 years, GPR systems have become a standard tool to evaluate hazardous underground sites in preparation for cleanup. From the relatively simple requirements of locating buried drums, underground storage tanks and waste disposal trenches...to the more complex tasks of mapping underground contaminant plumes and landfill boundaries, GPR systems significantly reduce the cost and risks of cleanup.

**SECURITY AGENCIES:** GPR has successfully located fine wires and other objects in walls. Hidden ammunition caches have also been detected.

**LAW ENFORCEMENT:** The FBI and the RCMP, as well as local law enforcement agencies, have used GPR equipment to locate buried bodies. GPR has been used to locate tunnels under prison walls, drug tunnels between country borders and mass burial sites.

**ARCHAEOLOGY:** The use of GPR in archaeology provides an invaluable technique for non-invasively mapping the subsurface – an essential tool in Cultural Resource Management. GPR has been used at many well-known sites, including the Great Pyramids in Cairo, the cliffs where the Dead Sea Scrolls were found in Israel, the discovery of bones from the largest dinosaur, the Seismosaurus, as well as the Siberian tundra in locating the remains of the first fully intact Woolly Mammoth.

**RESEARCH:** Under subcontract to the Smithsonian Institute, GSSI is developing a GPR system to go on a future Rover mission to Mars. The primary purpose is to identify creek beds where remnants of prior life might be found.

## **PARTIAL LIST OF U.S. GOVERNMENT AGENCIES USING GSSI SYSTEMS**

### **AIRFORCE:**

*Andrews AFB, Fairchild AFB, Griffis AFB, Hanscom AFB, Hickham AFB, Hill AFB, K.I. Sawyer AFB, McCord AFB, Moody AFB, Mount Home AFB, Plattsburgh AFB, Tinker AFB, Tyndall AFB, Wheeler AFB,*

### **ARMY:**

*Ft. Meade, Ft. Belvoir*

### **NAVY:**

*NAS Jacksonville, NAS Pascagoula, NAS Norfolk, Naval Public Works Center San Diego.*

### **MARINES:**

*Marine Corps Air Station, Yuma.*

US Bureau of Mines

US Bureau of Reclamation

US Bureau of Standards

US Coast Guard

D.O.D. (Pentagon)

USDA, Forest Service

US Environmental Protection Agency

FBI

NSA

US Geological Survey

US Parks Department

### **NATIONAL LABORATORIES:**

*Los Alamos*

*LLNA*

*Sandia*

*Oak Ridge*

*Brookhaven*

### **US Corps of Engineers:**

*CRREL (Cold Regions Research and Engineering Laboratory), Tulsa, WES.*

### **Department of Energy:**

*Savannah River, Hanford, INEL, Oak Ridge*

**Ground Penetrating Radar (GPR) – Fact Sheet  
Geophysical Survey Systems, Inc. (GSSI)**

**GPR Facts**

GPR uses an Ultra wideband (UWB) transmitter

*GPR systems transmit into solids and liquids; ALL other UWB transmitters transmit into the air*

GPR works in the time domain and any air transmission is unintentional and unwanted

Total power transmitted is 1/1000<sup>th</sup> that of a mobile phone

GPR technology enables non-destructive investigation of earth, concrete, ice and fresh water

No other technology for subsurface investigation can do what GPR does

*Many primary uses of GPR relate to public safety*

GPR and GPS systems are compatible as evidenced by their combined use for over ten years

Approximately 10 commercial GPR manufacturers in the world

Approximately 40 universities in the world teach or have GPR projects

Estimate 1,000 working systems in the US; another 1,200 working outside the US

GPR users are an Industry: trade shows, conventions, technical papers, government-sponsored projects for 20+ years

**FCC Rules**

Rules, Part 15, created in 1920's and 1930's for frequency domain transmitters to keep systems from interfering with each other

Rules did not contemplate UWB transmitters (time domain)

The FCC records indicate that GPR transmitters have never interfered with another receiver

UWB rules are now being written for the first time

Requirement for new rules coming from innovative UWB transmitters for consumer use in a new telecommunications market using air transmission

GPR antennas conform to emission limits Part 15 of the FCC rules (antenna exceptions can be fixed or deleted)

New UWB rules protect GPS frequency spectrum *beyond* reasonable limits, thereby eliminating GPR systems and an entire industry

**GSSI Facts**

Business started 1970, purchased by the Oyo Group, Tokyo, 1990

Developed and sold first commercial GPR systems in 1970

Average selling price \$25,000 per system (range \$13,000 to \$100,000)

A GSA supplier since 1984

Products sold in 50 countries and to over 30 government agencies in the U.S.

Some working systems are 10 to 15 years old, and still 'ticking'

*GPR and GPS are compatible* - GPR systems are sold with GPS systems without special modification

Standard uses for GSSI GPR equipment include:

- Utility pipe detection and mapping (*safety a consideration*)
- Concrete inspection to find rebar and pipes and fiber optic lines before cutting (*safety a consideration*)
- Highway inspection (voids, pipes, thickness) State DOT's, many foreign (*safety a consideration*)
- Bridge deck inspection for condition assessment and maintenance decisions
- Geophysical surveys (locate bedrock, water table, etc. detection of voids, anomalies)
- Airport runway inspection (all major airports and NASA) (*safety a consideration*)
- Railroad bed inspection (Amtrak, French, German, Swiss, India) (*safety a consideration*)
- Forensics (locating bodies, etc.)
- Define the extent of environmental contamination problems, pipe leaks, waste pits, etc. (*safety a consideration*)
- Archaeology - mapping of underground sites in 3D prior to digging
- Mining, location of mineral deposits, seams and water levels (*safety a consideration*)

Non standard uses (all in the last year; there are many more going back in time)

- Discovery of the woolly mammoth in Siberia (Discovery channel)
- Survey of unopened tomb in Xian, China
- Discovery of unknown village near Macchu Pichu (National Geographic expedition)
- Surveys at Mount Vernon, Monticello, and FDR's home
- Frozen river bed survey - Russia
- Survey on the grounds of the leaning tower of Pisa
- Discovery of emerald deposit last month in North Carolina, North Americas largest
- Develop GPR system to go to Mars to define creek beds where remnants of life might be found

Use these links to our web sites for detailed information:

<a href="http://www.geophysical.com">www.geophysical.com</a>	main site
<a href="http://www.archeologymapping.com">www.archeologymapping.com</a>	archeology
<a href="http://www.structurescan.com">www.structurescan.com</a>	concrete inspection
<a href="http://www.highwayscan.com">www.highwayscan.com</a>	highway / bridge inspection