

GLOSSARY OF RADAR (GROUND PENETRATING RADAR) TERMINOLOGY

Symbol or term	Explanation
<i>ABC</i>	Abbreviation for Active Background Canceller
<i>Active Background Canceller</i>	A device (being developed in ORFEUS) capable of adaptively cancellation of the effects of the soil as they are perceived by the antenna system.
<i>A Scan</i>	According to the radar terminology, it indicates the display of the GPR trace in the form of wavelets (like the signals one would see on an oscilloscope)
<i>Antenna</i>	Usually the GPR antenna is meant to include the transmitter, the receiver and the radiating elements (i.e. the true antenna; but see monostatic and bistatic).
<i>Antenna separation</i>	Spacing between Tx and Rx antennas
<i>Apparent Depth</i>	The estimated depth of targets based upon an assumed velocity of propagation in the soil (see Relative Permittivity)
<i>Attenuation (α)</i>	A reduction in GPR signal amplitude caused by energy dissipation in the radiated material (commonly expressed in dB/metre)
<i>B Scan</i>	Same as GPR section (radar terminology)
<i>Bandwidth</i>	Frequency range transmitted by the GPR
<i>Bistatic</i>	Tx and Rx antennas are separated in space (see Antenna and Antenna Separation)
<i>C Scan</i>	3-D display of GPR data; it results from the side-by-side display of a number of GPR sections in a 3-D volume
<i>Centre Frequency</i>	Middle of the frequency band defined in Bandwidth
<i>Clutter</i>	Interfering signal comprising all of the components of the GPR that interact with each other and the ground to generate multiple signals that produce a signal that competes with, and may mask, reflections from targets. This is the most significant limitation on the overall performance of GPRs
<i>Detection</i>	Generally speaking, it is the process of deciding on the existence, or not, of a target.
<i>Detection range</i>	The maximum distance at which the radar can provide a signal useful for detection. For GPR it is also called depth of penetration and is primarily affected by the signal attenuation caused by the ground.
<i>Detection rate</i>	Usually expressed as a percentage of the total number of targets available for detection
<i>Dispersion</i>	The tendency of the velocity of propagation in the soil to change, depending upon the frequency of the EM wave, causing the received time domain signal to be distorted (see Relative Permittivity)
<i>Dynamic range</i>	The ratio, usually expressed in decibels (dB), between the maximum amplitude signal recordable by the GPR and its noise floor. It is usually limited by the clutter. A large, clutter-free dynamic range is a basic requirement for a GPR.
<i>Electrical Conductivity (σ)</i>	The reciprocal of resistivity expressed in siemens/metre (a property of the ground that determines its attenuation)
<i>EM</i>	Abbreviation of Electromagnetic
<i>False alarm rate</i>	Usually expressed as a percentage of the total number of true targets detected by the radar
<i>FMCW</i>	Abbreviation for Frequency Modulated Continuous Wave
<i>Frequency-domain GPR</i>	In these systems, the frequency of the transmitted signal is constantly varying with time. The usual implementation of this technology in GPRs is named "Stepped-Frequency" because the frequency is changed in discrete, highly repeatable and stable, steps.

<i>Frequency Modulated Continuous Wave Radar</i>	A radar system where radio energy is modulated in order to increase bandwidth and range resolution. Signal modulation can be sawtooth, stepwise, sine, etc.
<i>Gain</i>	Process of amplifying signals to match the dynamic range of the display or the recording device
<i>GHz</i>	Giga Hertz, i.e. 10^9 of cycles per second
<i>GPR</i>	Ground Penetrating Radar or Ground Probing Radar. It designates a class of radar systems used to detect buried targets in, for example, the ground.
<i>GPR section</i>	The cross-sectional image produced by a GPR; it results from side-by-side 2-D display of a number of traces which are collected at adjacent spatial measurement position during the GPR collection. Usually the amplitude of the recorded traces are represented by means of a grey or colour scale.
<i>GPR signal Velocity (v)</i>	The speed of a GPR signal propagating through a material. It varies according to the characteristics of the material itself.
<i>GPR trace</i>	Sequence of sample points collected by the GPR in a position, that indicate time variation of the amplitude of the recorded signal
<i>MHz</i>	Mega Hertz, i.e. 10^6 of cycles per second
<i>Microsecond (μsec)</i>	10^{-6} second
<i>Monostatic</i>	Tx and Rx antennas occupy the same volume
<i>Nanosecond (nsec)</i>	10^{-9} second
<i>Picosecond (psec)</i>	10^{-12} second
<i>Radar Cross Section</i>	Describes the extent to which an object reflects an incident electromagnetic wave. It is a measure of the strength of the radar signal backscattered from a "target" object for a given incident wave power, and is measured in square metres
<i>Radio wave</i>	Electromagnetic fields that travel through a material as waves. For the GPR, frequencies between 10 MHz and few GHz are common
<i>RCS</i>	Abbreviation for Radar Cross Section
<i>Receiver</i>	It is the device of the GPR that processes the radio wave reflected by targets and captured by the receiving antenna. It converts the wave into a signal recordable by the GPR
<i>Receiving antenna</i>	It is the transducer that captures the radio wave back-scattered by a target
<i>Relative Permittivity(ϵ)</i>	It is the ratio of the velocity of propagation of EM waves in free space to their velocity in the soil. The value of ϵ may depend upon the frequency of the EM wave (See Dispersion)
<i>Resolution</i>	The minimum separation between two targets before their individual responses merge into a single response.
<i>Rx</i>	Common abbreviation for receiver, i.e. a device that receives EM energy
<i>Sample point</i>	Signal amplitude measured at a specific position in time
<i>Target</i>	In the radar terminology, target is meant as any object whose detection is the primary objective of the system. A similar definition can be used for the GPR
<i>Time-domain GPR</i>	Present state-of-the-art GPRs that radiate a very short pulse of electromagnetic energy.
<i>Timeslice</i>	Bidimensional image produced by slicing the 3-D volume (C-scan) perpendicularly to the time axis (z)
<i>Trace stacking</i>	It is the averaging of some GPR traces collected at the same position in order to reduce the noise level in the collection, thus increasing the dynamic range
<i>Transmitter</i>	The source of the signal feeding the transmitting antenna
<i>Transmitting antenna</i>	The transducer that produces the radiated GPR radio wave
<i>Tx</i>	Common abbreviation for a device that transmits EM energy