GLOSSARY

Absorption - The transmitted R.A.D.A.R. beam will, unless otherwise acted upon (absorbed, reflected, or refracted), travel infinitely far. Under practical circumstances, the beam may be partially absorbed by natural and man-made substances. Vegetation such as trees, grass, and bushes will absorb R.A.D.A.R. energy. Freshly turned earth, such as that in a freshly plowed field, will also absorb R.A.D.A.R. Plastics of certain types and foam products will absorb R.A.D.A.R., as makers of "stealth" automotive accessories have discovered. Absorption of R.A.D.A.R. will not result in any inaccuracies in the R.A.D.A.R. readings. It will reduce the strength of the returned signal, and the operational range of the device depending upon the circumstances.

Absolute speed limits - Holds that a given speed limit is in force, regardless of environment conditions, i.e., 35 mph or 50 mph.

Accuracy - When used in conjunction with R.A.D.A.R. devices means the degree to which the R.A.D.A.R. device measures and displays the correct speed of a target vehicle that it is tracking.

Ambient interference - The conducted and/or radiated electromagnetic interference and/or mechanical motion interference at a specific location and at a time which would be detrimental to proper R.A.D.A.R. performance.

Antenna horn - The antenna horn is that portion of the R.A.D.A.R. device that shapes and directs the microwave energy (beam). The antenna horn also "catches" the returning microwave energy and directs it to the R.A.D.A.R. receiver. The cone-shaped antenna horn, usually manufactured of a thin metal, often aluminum, which may be damaged if mishandled. A dented or damaged antenna horn must not be used for speed measurement as inaccurate results may occur due to misdirection of the antenna beam. The antenna horn is used for both directing the transmitted beam and capturing the received (reflected) R.A.D.A.R. signal. Components at the base of the horn separate the transmitted and received signals.

Antenna horizontal beam width - The total included acute angle, inthe horizontal plane, of the main lobe between the half-power points of the R.A.D.A.R. antenna far-field radiation pattern, where the half-power points are measured relative to the maximum power at the center of the beam and on a radius equidistant from the face of the antenna.

Antenna turnstile - The antenna turnstile is a small protuberance, or "post" inside the small end of the antenna horn that directs the R.A.D.A.R. beam's microwave energy so as to allow the same antenna to be used for both transmitting and receiving R.A.D.A.R. energy.

Aperture - "A hole, gap, slit, or other opening; an orifice" (Webster). In a R.A.D.A.R. device the aperture would be the large open end of the antenna horn through which the R.A.D.A.R. beam emerges.

Audio Doppler - An audible signal from a R.A.D.A.R. device that is generated by driving a loudspeaker with the Doppler shift beat frequency or with the Doppler shift beat frequency divided by a fixed factor, provided the audio sound corresponds directly with changes in speed of target vehicle and any ambient interference present is discernible.

The strength of the R.A.D.A.R. beam that is returned to the R.A.D.A.R. device is very small. In order for the R.A.D.A.R. receiver to make use of this signal it must be amplified. This amplification takes place after the received microwave energy is captured by the antenna horn and directed to the receiver portion of the device. The signal is amplified, hence the term "gain", as the signal has gained strength through the amplification.

Auto Gain - R.A.D.A.R. devices rely on many automatic functions to facilitate technical operation. The receiver uses a circuit that constantly seeks a valid R.A.D.A.R. signal. If the receiver cannot detect such a signal, it automatically turns up the amplification, or gain. This searching for a R.A.D.A.R. signal continues as long as no signal is detected. The amplification is increased a little, at a time until a usable signal level is attained, at which point the amplification increase stops. If no signal is present, the auto gain may be operating at maximum gain. This receiver condition, termed "running wide open", is often responsible for what are called ghost readings", such as the 88 mile per hour tree. These ghost readings instantly disappear when a valid R.A.D.A.R. target signal is processed.

Automatic lock - A control function of a R.A.D.A.R. device that, when activated, causes the device to automatically retain the displayed speed of a target vehicle when the target vehicle speed exceeds some preset value, and preserve that speed displayed until manually reset by the operator. (Devices equipped with automatic lock do not meet the specifications adopted by NHTSA, National Institute for Standards and Technology [formerly NBS], or the International Association of Chiefs of Police.)

Batching effect - Spurious or no target speed display readings due to rapid changes in patrol vehicle speed.

Calibrate - To physically modify or adjust by determining the deviation from a known standard. (R.A.D.A.R. operators do not calibrate R.A.D.A.R. units. They use tuning forks, internal circuit tests, etc., to check them for accuracy.)

Circular Polarized Beam - The electric field radiated by the antenna horn rotates in a circular fashion, like a corkscrew. This beam may be polarized as either a left-hand or right-hand fashion. Many R.A.D.A.R. devices use left-hand polarization.

Closing Speed- The speed at which an identified target is moving relative to the R.A.D.A.R. device (whether the R.A.D.A.R. device is moving or not) when measured on a straight line (radius) from the R.A.D.A.R. to the target.

Consumer Product List (CPL) - The National Highway Traffic Safety Administration (NHTSA) has entered into an agreement with the International Association of Chiefs of Police (IACP) and the National Institute of Standards and Technology (NIST) to test all RADAR devices marketed for police speed measurement purposes. Those devices which successfully pass the NIST tests are added to the Consumer Product List (CPL). A RADAR model's appearance on the list means that particular model may be used with reasonable expectations of accuracy and reliability.

Cosine effect - The effect due to the target not traveling directly toward the R.A.D.A.R. device, which lowers the Doppler shift frequency in proportion to the cosine of the angle between the direction of travel of the R.A.D.A.R. target and a line from the R.A.D.A.R. device to the target.

Cosine effect stationary mode - Exists when the direction of travel of the target vehicle is not proceeding on a direct path to or from the R.A.D.A.R. antenna. This may result in a target speed display that is less than the actual speed.

Cosine effect moving mode - Similar to that which is found in the stationary mode except that in the moving mode cosine may effect the patrol speed. When the cosine affects the patrol speed, the target speed may be higher. Therefore, cosine in the moving mode may cause either a higher or lower target speed.

Cross Section - "A section formed by a plane cutting through an object, usually at right angles to an axis" (Webster). Beam cross-section refers to the area perpendicular to the beam axis, enclosed at any fixed distance from the antenna by the half power point.

We may also refer to the cross section of a R.A.D.A.R. target. Also referred to as target size, the cross section of a target more correctly refers to the effective area presented to the R.A.D.A.R. beam from which the beam may be reflected. It is a function of several factors including the projected geometrical area of the target, the curvature of its surfaces, and the conductivity of the target material.

Cycle - "A time interval in which a characteristic, especially a regularly repeated event or sequence of events occurs" (Webster). The R.A.D.A.R. beam transmits energy as a series of waves. Over the period of one cycle the wave rises, falls, then rises again. (Also see Wave)

Decibel - "A unit used to express relative power levels, usually between acoustic or electric signals, equal to ten times the common logarithm of the ratio of the two levels" (Webster). In a R.A.D.A.R. device the term decibel (dB) is used when describing power levels. A 28dB signal, for example, is twice as powerful as a 25dB signal because 3dB corresponds to a ratio of 2. Decibels increase logarithmically rather than linearly with signal strength.

Display - A visual readout device.

Doppler Principle - The Austrian scientist, Christian Johann Doppler (1803-1853), observed that the sound pitch of an approaching train whistle appeared higher than when the train was alongside him. He also observed that the pitch of the whistle appeared to decrease as the train went away from him. The Doppler principle states "When there is relative motion between two objects, one of which is transmitting wave energy, the frequency of the signal as received by the other object changes due to that relative motion". Police traffic R.A.D.A.R. is based upon this Doppler effect, hence the term "Doppler R.A.D.A.R.".

Doppler Shift - The magnitude of the frequency range of the R.A.D.A.R. return signalreceived when the source and the R.A.D.A.R. reflecting target are in motion relative to one another.

Drone R.A.D.A.R. - Defined as the unconventional use of police traffic R.A.D.A.R. in either an attended or unattended mode for speed deterrent purposes.

Electromagnetic Interference - Electrical devices tend to be surrounded by an electromagnetic field. This field, or zone of influence, may be disruptive to other electronic devices. Usually electronic devices are protected (shielded) against stray fields, however, given the right circumstances, a field may cause a problem. R.A.D.A.R. devices are shielded against most fields but some interference may occur given the right conditions. These conditions usually are the result of placing an electrical device too close to the R.A.D.A.R. unit. Electromagnetic interference is capable of causing abnormal readings on a R.A.D.A.R. device.

Erroneous reading - An incorrect target speed displayed by the R.A.D.A.R. device, one that is not due to a target vehicle or which is not within the required accuracy tolerance of the speed of a target vehicle, excluding known correction factors such as the cosineeffect.

Far-field region - That region beyond the close proximity of a transmitting antenna defined by the relationship where “d” is the horn diameter and “l” is the wavelength of the transmitted frequency, in consistent units.

Frequency - "The number of times a repetitive phenomenon occurs within a specified interval, as: The number of complete cycles of a periodic process occurring per unit time" (Webster). A frequency of ten cycles per second means that ten oscillation occur within that one second time span. R.A.D.A.R. devices utilize particular frequency ranges, authorized by the Federal Communications Commission (FCC). These frequency ranges, or "bands", are centered at 10.520 GHz (X-band) and 24.150 GHz (K-band). Other R.A.D.A.R. speed measurement devices operate in the Ka band, between 33.4 to 36.0 Ghz.

Frequency spectrum - Communications engineers define this as a range of frequencies appropriate to the operation of an electronic device.

Gas Plasma Display - Some R.A.D.A.R. devices use a speed display in which glass, gas-filled tubes containing ten thin, fragile wires are used to form the numerals 0 through 9. When electric current is applied to a specific formed wire, the gas inside the tube surrounding the surface of that formed wire glows, thereby making a number visible. Usually two or three tubes are used as the R.A.D.A.R. display. Although the gas tube displays may be quite bright and provide good visibility in bright light, they are subject to damage through shock and subsequent breakage of the fragile wires.

Gigahertz (Gigacycles per second) - R.A.D.A.R. operates in the "microwave" band at frequencies of many billions of cycles per second. The prefix "giga" is used to indicate "billion". For example the X-band R.A.D.A.R. device operates at a center frequency of 10.525 gigahertz (remember one cycle per second is equal to one hertz).

Half Power Point - In the far field region, at any given distance from the face of the antenna, the half power points are those locations where the power has fallen to one-half of the power on the beam axis. For example, if we were to take a photographic light meter and hold it up to a flashlight beam, we would obtain a high reading. Let's say we get a reading of 10. The half power points of that beam would be the physical location on either side of the light source, where the light meter is reading 5, or one half of the original source's energy. The half power points of a RADAR device are used to give relative descriptions of the beam width.

Hertz - Originally frequencies were designated in units "cycle per second", as in thirty cycles per second. In honor of Heinrich Rudolph Hertz (Germany, 1857-1894) the term hertz has been designated as the replacement word for "cycles per second", as in "thirty hertz".

High Doppler Filter - In a moving R.A.D.A.R. device we know that the basic computation is Closing Speed (high Doppler signal) minus Patrol Speed (low Doppler signal) equals Target Speed. The high Doppler is that portion of the signal reflected from the target vehicle back to the R.A.D.A.R. antenna. This high Doppler signal is the sum of the transmitted frequency plus the frequency shift resulting from the relative motion between the target and patrol vehicles. This, then, is a very high frequency signal. The high Doppler filter is a electrical device that allows a specific range of return frequencies to pass. This range of frequencies describes that range of closing speeds that the R.A.D.A.R. is designed to handle.

Induced EMF- "The generation of electromotive force (EMF) in a closed circuit by varying magnetic flux through the circuit" (Webster). A current passing through a wire will generate a magnetic field, or flux. If this field is allowed to pass through a nearby wire in another circuit, then the second wire may have an induced EMF within it. In a R.A.D.A.R. device this may cause problems for an operator. For example, when the R.A.D.A.R. unit power cable is wound around the antenna cable, the power cable may induce spurious signals in the receiver circuit.

Integrated Circuit (IC) - Modern R.A.D.A.R. devices utilize a device known as an integrated circuit (IC). An integrated circuit is a solid state device in which a large number of micro-miniaturized electronic devices are encapsulated and integrated into a single "chip". For example, an entire R.A.D.A.R. signal receiver-amplifier circuit may be placed on a single IC chip. The obvious advantages are size and cost reductions as well as greater reliability. In some R.A.D.A.R. device IC chips may be replaced to upgrade the R.A.D.A.R. to operate in new and different ways, thereby side-stepping obsolescence.

Internal circuit test - A test function (whether manually or automatically initiated) that verifies that all R.A.D.A.R. device internal signal processing circuitry, except for the microwave transmitter and receiver, is working correctly, i.e., all target and patrol vehicle signals will be properly processed and displayed.

Judicial notice - The act by which a court will of its own motion, and without the production of evidence, recognize the existence and truth of certain facts.

Just acquired distant target - A target just within the range of a R.A.D.A.R. device which was originally beyond the range and now provides a display signal of target speed.

K-Band - The portion of the electromagnetic spectrum including 24,150,000,000 cycles per second, or 24.150 gigahertz, at which a class of police traffic R.A.D.A.R. devices operate. One advantage of K-band over X-band R.A.D.A.R. devices is that a smaller antenna may be used because the frequencies are higher than those of the X-band.

Ka-Band - Sometimes referred to as a "subset" of the K-band. The FCC currently permits police traffic R.A.D.A.R. operation anywhere within the range between 33.4 to

36.0 gigahertz. The purpose of designing units that operate in this band is to attempt to defeat some of the R.A.D.A.R. detectors that may not currently be able to detect this frequency.

Lensed Antenna - Due to customer demands for smaller R.A.D.A.R. antennas, R.A.D.A.R. manufacturers responded with lensed antenna designs. A lensed antenna uses a plastic, usually Lexan, in a carefully designed shape to act as a "lens" for the R.A.D.A.R. beam. The lens employs the use of the principle of R.A.D.A.R. beam refraction in shaping and aiming the R.A.D.A.R. beam while using a small antenna structure. This lens usually takes the shape of a spherically shaped end-piece of the antenna. It is important to make sure that this end-piece is not damaged or significantly scratched, as the R.A.D.A.R. beam may be distorted by passing through the damaged area.

Light Emitting Diode (LED) - This is a device used to display the various functions of the R.A.D.A.R., such as the speed display. Usually red in color, each LED has seven segments which may be independently lighted to display a number. An "8" for example, would require all seven segments to be lit, where a "3" would require only five. Other LEDs are used as indicators, such as "Power On" or "RFI".

Liquid Crystal Display - This display device is similar to the LED in that seven segments may be used, however the LCD uses reflected light through the crystal to display the segments. For nighttime use a light source is placed behind the LCD display to make it more visible.

Low Doppler Filter - This electronic component of the moving R.A.D.A.R. device allows only a certain band of frequencies to be passed through it. The low Doppler is the returned microwave energy from the roadway in front of the moving vehicle, and is necessary so that the R.A.D.A.R. unit may establish the Patrol Speed (remember the basic computation for moving R.A.D.A.R. is Closing Speed minus Patrol Speed equals Target Speed). The manufacturers design the low Doppler filter so that return frequencies in the range from 20 mph to 70 mph will be accepted. The frequencies that are allowed to be processed are said to have "passed" the low Doppler filter. For this reason the low Doppler filter is sometimes termed the "low pass" filter.

Low Voltage - All electric devices are engineered to operate on a power supply that does not exceed high or low limits. The lower limit on many R.A.D.A.R. devices is 10.8 volts. If the voltage drops below this value, most R.A.D.A.R. units will automatically "shut down" so that incorrect operation will not take place. No speeds will be displayed or locked. The current NHTSA/IACP specifications require that all new R.A.D.A.R. units have a low voltage display that will warn the operator of this condition.

Low voltage conditions frequently occur when a stopped vehicle's engine is started in order to pursue a violator. The act of starting the engine creates a very large current demand, often causing the voltage of the electrical system to momentarily drop below ten volts. This voltage drop will cause most R.A.D.A.R. devices to react to the low voltage. Those R.A.D.A.R. units with low voltage displays will show this condition, while others may simply lose any present reading and/or stop normal operation. This is not a harmful event for the R.A.D.A.R. device, however, attempts at extended operation on low voltage may cause unpredictable readings or no readings at all.

Low voltage indicator - A R.A.D.A.R. device component which alerts the operator to the fact that a low supply voltage condition exists.

Luminance- The photometric brightness or the luminous intensity of any surface in a given direction per unit of projected area of the surface as viewed from that direction.

Luminance contrast - The relationship between the luminance of an object and the luminance of its own background.

Main Axis - The antenna beam of a R.A.D.A.R. device is conical and directed forward towards an intended target. When the antenna is aligned with a distant target, the main axis would be an imaginary line from the antenna horn to the target. This is the direction of the greatest concentration of the R.A.D.A.R. beam strength. This imaginary line is used when describing the beam width, such as "six degrees from main axis to half power points."

Megacycles - Using the prefix "mega", meaning 1,000,000 gives us another way to indicate frequency. 155,250,000 cycles per second would then equal 155.250 megacycles per second, or more correctly, 155.250 megahertz.

Microprocessor - This electronic device is the "brain" of the R.A.D.A.R. unit. It is a solid state micro chip device containing the program of instructions to interpret speeds, calculate them, and display them to the operator. It processes the input data and provides the other components with the information to display or otherwise indicate to the operator what operation is going on.

Microwave output power - That part of the total power produced by the microwave generator in the R.A.D.A.R. devices.

Microwave Oscillator - A R.A.D.A.R.'s antenna energy source.

Millisecond - A millisecond is a thousandth of a second. This term is sometimes used to describe the speed of an electrical event. At the speed of light, a R.A.D.A.R. signal would travel nearly a million (983,000) feet in one millisecond.

Moving mode - The capability of a R.A.D.A.R. device to measure and display the speed of a target vehicle while the R.A.D.A.R. device is moving with respect to the surrounding terrain.

mW/cm2 - (note: this is one milliwatt per centimeter squared) When the power of a R.A.D.A.R. beam is measured, a power meter probe is placed at the aperture of the R.A.D.A.R. antenna horn. The strength of the beam is stated in milliwatts of power per square centimeter. This gives us a relative value that we may apply to other devices to compare them, or to meet standards. A square centimeter (l/lOOth of a meter) is a little over 3/8th of an inch square.

Nanometers - This term us used to designate billionths of a meter.

Nanosecond - A billionth of a second. At the speed of light, a R.A.D.A.R. signal would travel only about one foot in one nanosecond!

National Institute of Standards and Technology (NIST) - The NIST is a federal laboratory which provides a wide range of services. One of these is to supervise the testing of all submitted R.A.D.A.R. models submitted by manufacturers who wish to have them placed on the Consumer Products List (CPL). This gives the users assurance of the quality of the design, operation, and reliability of the particular R.A.D.A.R. model.

Near-field region - That region in close proximity to the transmitting antenna that is not included in the region defined as "far-field region."

Negative Ground - Almost all vehicles equipped with an electrical system utilize what is termed as a negative ground electrical system. This means that the negative terminal of the battery as well as all other electrical components use the chassis or frame of the vehicle for the return path of the electricity to the battery. Many electrical devices may be permanently damaged if incorrectly connected to the power source. Some of the newer R.A.D.A.R. units have what is termed "reverse polarity protection" which is a circuit that prevents device damage in the event of accidental connection to the power the wrong way, e.g., positive to negative and negative to positive.

Nominal value - The numerical value of a device characteristic as specified by the manufacturer.

Operational area of the beam - The area of a R.A.D.A.R. beam in which a valid target reading may beaccepted.

Opposite direction moving mode - That a R.A.D.A.R. device has the ability tomeasure and display the speed of a target vehicle while the R.A.D.A.R. device and the target vehicle are moving in opposite directions.

Panning effect - A hand held R.A.D.A.R. antenna that is swung swiftly or "panned" past the side of a parked car, brick wall, or some other stationary object is alleged to produce a speedmeasurement.

Patrol speed - The speed at which the patrol vehicle is moving with respect to the surrounding terrain.

Patrol channel - That portion of the R.A.D.A.R. circuitry of a R.A.D.A.R. device that processes and calculates the speed of a patrol vehicle when the R.A.D.A.R. device is operating in the moving mode

Phase-lock Loop - This is an electrical circuit often employed in frequency synthesis and other circuits. When properly engineered this circuit allows fewer components to be employed in the R.A.D.A.R. device. Some detractors of R.A.D.A.R. have blamed the phase-lock loop for R.A.D.A.R. inaccuracies, however proper R.A.D.A.R. design, operator training, and operation following the manufacturer's recommended procedures eliminates these objections.

Pitch - An audible tone that is determined by the frequency of the waves producing it.

Polarization - That property of a radiated electromagnetic wave describing the time-varying direction and magnitude of the electric field vector.

Power surge effect - A term that describes spurious speed displays that may be caused by momentary high voltage conditions.

Power density - Power density per unit area or energy density flux per unit area.

Prima facie speed limit - Holds that a given speed limit is valid on its face, however, a valid defense may challenge whether the speed observed is unsafe, i.e., this includes some speed limits that are set by city ordinances.

Quartz Crystal Oscillator - The R.A.D.A.R. device depends upon very accuratefrequency determination. To meet the need, quartz crystals are employed which oscillate (vibrate) at very specific frequencies. These crystals are actually pieces of man-made crystal, precision ground to very strict tolerances. When electrical current is applied to a crystal it will oscillate at its designated frequency, providing a stable reference for the rest of the frequency-dependent circuits.

Quartz Crystal Time Base - Because the R.A.D.A.R. device uses time as a part of the overall computation of speed, very accurate time measurement must occur. The term quartz crystal time base refers to the circuit that provides this timing. A precision crystal is used to provide the "counts" which the R.A.D.A.R. employs in calculating frequency and speed. It may be compared to an exceptionally accurate electronic clock.

R.A.D.A.R. Detector - An electronic device capable of sensing electromagnetic energy which emits a warning either audibly or visually or a combination of both.

R.A.D.A.R. Beam- Directed microwave energy, at a single frequency, which originates at the antenna.

Radio Frequency Interference (RFI) - Most electronic devices are surrounded by electromagnetic fields. This is usually not a problem, as almost all such devices must meet FCC restrictions as to how much radio frequency interference a device may emit. Because R.A.D.A.R. devices are sensitive to external radio frequencies, they are engineered to either shut down when outside radio frequencies are encountered, or to display a warning to the operator that radio frequencies may be present. This warning is usually labeled "RFI", for radio frequency interference.

Reflection - Remember that R.A.D.A.R. beams travel infinitely far unless absorbed, reflected, or refracted. The operation of R.A.D.A.R. depends upon portions of the transmitted R.A.D.A.R. beam striking objects and being reflected, or "bounced back", by these objects back to the R.A.D.A.R. receiver. This reflected R.A.D.A.R. energy is used to determine the relative motion and then speed of the object. R.A.D.A.R. beams reflect best from conducting objects. Metal, concrete, and nonmetallic materials painted with metallic paint will reflect R.A.D.A.R. energy well.

Refraction - Refers to the "bending" of the R.A.D.A.R. beam as the beam passes through some material. This phenomena is used to focus the R.A.D.A.R. beam in the lensed antennas. The beam is passed through the specially shaped lens and refracted into the desired shape. Other refraction occurs when a R.A.D.A.R. beam passes through a material which is not designed to focus the beam. This unintentional refraction may deform the beam, and cause it to "look" at the wrong targets. Refraction will not cause inaccurate R.A.D.A.R. readings, however, the wrong target may be selected and processed.

Reverse Polarity - The electrical system of most vehicles has the positive terminal of the battery and hence the supply wire for all the electrical components connected together. The negative terminal of the battery is connected to the frame of the vehicle, forming the electrical ground or return for the electrical circuit. When this connection scheme is reversed, and the positive wires connected to the negative source, we say that we have reverse polarity. This is not usually a desirable condition, and may damage or destroy electrical components if left that way.

RS-232 Port - A RS-232 port is an electronic connection point which conforms to certain standards so far as the electrical signals that may be obtained there. This allows us to connect other devices to a R.A.D.A.R. unit equipped with a RS-232 connection, such as a micro computer, to gather speed data, or a large display device for public information programs. The term RS-232 port may also be referred to as a "serial port".

Scanning - This can occur only with two piece R.A.D.A.R. units; devices whose antennas and counting units are physically separate. If the antenna is pointed at its own counting unit, a speed reading may appear on the display because of electronic feedback between the twocomponents.

Seven Segment Display - The displays used in almost all R.A.D.A.R. devices today use some sort of seven segment display. These devices are capable of displaying the numbers from 0 to 9, and may also represent some alphabet letters. Care must be exercised when using seven segment displays, because failure of one of the segments will result in a wrong numeral being displayed. This is why every R.A.D.A.R. device using seven segment displays uses a "light test" which activates all segments of all displays (the number "8" is used because requires all seven segments).

Shadowing effect - A patrol speed display (lower than actual) which occurs when a moving mode R.A.D.A.R. uses a slow moving vehicle, traveling in the same direction as the patrol vehicle, rather than the road surface or other stationary objects to measure the patrol vehicle's speed which is displayed as the difference in speed between the patrol vehicle and the slow moving vehicle.

Side Lobes - The R.A.D.A.R. beam is often described as "cigar-shaped". This may be true of the main portion of the beam, however a small fraction of the emission is also radiated to the sides of the main beam. Because of the design of the antenna the majority of the R.A.D.A.R. energy is directed forward. The amount of R.A.D.A.R. energy decreases as a function of the distance from the axis of the central portion of the beam towards the sides of the beam. There is measurable R.A.D.A.R. energy to the sides of the antenna, hence the term "side lobes". These side lobes represent a very small portion of the overall transmitted energy. We may observe the presence of the side lobes when a target vehicle passes a stationary R.A.D.A.R. unit. The vehicle is "tracked" up to and even as it passes the R.A.D.A.R.'s location. Although the indicated speed decreases to zero because of the cosine effect, still we are able to detect its presence because of the side lobes.

Solid State - Solid state refers to the use of semiconductor components, such as transistors, integrated circuits, and switches to perform electronic functions. They are far more reliable, produce less heat, and cost less that their mechanical counterparts.

Speed display lock - A R.A.D.A.R. control that causes speed on display as target speed and patrol speed to be retained on display until reset.

Speed monitor alert - A function that alerts the operator when a target speed signal is received that is equal to or above some pre-selected threshold speed. This function should bedisabled.

Speed of Light - Over the years scientists have measured how fast radio waves travel. They have determined that radio waves travel at the speed of light, or 186,282 miles per second.

Spurious display - A speed display that is produced by something other than a valid target or patrol vehicle

Squelch - The capacity of a R.A.D.A.R. to inhibit the Doppler audio sound when the RADAR is in operation and not receiving a target signal.

Squelch Control - R.A.D.A.R. devices are frequently left operating for long periods of time. The R.A.D.A.R. receiver requires a device to cut off, or squelch, weak or background noise when no signal is present. This is usually variable control which the operator may adjust to set the threshold at which point the background noise is squelched, or turned off. Any subsequent signal which exceeds that point will be heard, any weaker and it will not. Automatic squelch is used to prevent weaker signals or background noise from being heard. Only the desired signals will be allowed to be passed to the speaker.

Standby mode - A function of a R.A.D.A.R. device that allows the operator to inhibit power to the microwave oscillator circuit.

Stationary mode - The capability of a R.A.D.A.R. device to operate from a fixed location and display the speed of a target vehicle within the required accuracy tolerance.

Target speed - The speed at which the target vehicle is moving with respect to the surrounding terrain.

Channel- The portion of the R.A.D.A.R. circuitry that processes the closing speed signal, and calculates and displays the speed of a R.A.D.A.R. target.

Target vehicle - The vehicle identified as producing a given Doppler R.A.D.A.R. signal that is processed and displayed by the R.A.D.A.R. device as the target speed.

Target speed formula - TS = CS - PS: is a formula for "target speed" equals "closing speed" minus "patrol speed".

Track-Through-Lock - The feature of a R.A.D.A.R. device whereby the unit continues to measure, process and accomplish audio Doppler tracking and, in some cases, display in real time the target speed after the speed lock switch has been actuated to the lock condition.

Tracking History - A term that is used to describe a list of necessary elements in any R.A.D.A.R. enforcement. It should include: 1) visual observation of the target including an estimation of the target's speed, 2) Doppler audio is consistent with the target speed display and visual observations, including estimate of target speed, 3) target display speed is consistent with visual estimate and audio output, 4) target is within the operational area of the beam when the reading is taken, and 5) patrol speed display corresponds with the calibrated speedometer (this element only applies to the moving mode).

Truncate - "To shorten by cutting off a part." This refers to the R.A.D.A.R. target speed display which shows no tenths of a mile per hour. The target vehicle speed is truncated down to a whole number. For example, 67.3 miles per hour is displayed as 67 miles per hour.

Tuning fork - A mechanical self-resonant device, which when excited, produces free oscillations that may be used to generate a pseudo Doppler frequency reference when placed in the. R.A.D.A.R. antenna beam.

Tuning Fork Operation - The tuning fork is a carefully machined piece of metal, shaped into two tines which, when tapped on an object, which should be non-metallic, will vibrate at a specific frequency. The tuning fork(s) are used as an external check of the accuracy of the R.A.D.A.R. device. Because R.A.D.A.R. detects motion, the vibrating tines are interpreted as a particular target speed. Forks are usually stamped with the operating band (X-band or K-band), and the speed the particular fork should cause the R.A.D.A.R. to display. Stationary R.A.D.A.R. devices use one fork while moving R.A.D.A.R. employs two forks. The R.A.D.A.R. device and tuning fork(s) should be calibrated as a set. Forks should not be interchanged among other R.A.D.A.R. devices due to this calibration and certification as a set.

Type I R.A.D.A.R. device - A R.A.D.A.R. device that transmits microwave energy in the 10,500 to 10,550 MHz frequency band (in the X-band) and operates only in the stationary mode.

Type II R.A.D.A.R. device - A R.A.D.A.R. device that transmits microwave energy in the 10,500 to 10,550 MHz frequency band (in the X-band) and operates in both the stationary and moving modes.

Type III R.A.D.A.R. device - A R.A.D.A.R. device that transmits microwave energy in the 24,050 to 24,250 MHz frequency band (in the K-band) and operates only in the stationary mode.

Type IV R.A.D.A.R. device - A R.A.D.A.R. device that transmits microwave energy in the 24,050 to 24,250 MHz frequency band (in the K-band) and operates in both the stationary and moving modes.

Type V R.A.D.A.R. device - A R.A.D.A.R. device that transmits microwave energy in the 33,400 to 36,000 MHz frequency band (in the Ka-Band) and operates only in the stationary mode.

Type VI R.A.D.A.R. device - A R.A.D.A.R. device that transmits microwave energy in the 33,400 to 36,000 MHz frequency band (in the Ka-Band) and operates in both the stationary and moving modes.

VDC - All the R.A.D.A.R. units manufactured or in use today use what is termed direct current as opposed to alternating current. This is what automobiles, motorcycles and battery packs provide for power to the R.A.D.A.R. units. The term "VDC" means volts direct current, and usually appears in the R.A.D.A.R. manufacturer's specifications such as "Power requirements: 10.8 to 16.5 VDC, l.5A maximum". This would mean the R.A.D.A.R. will function normally only when provided with power at from between 10.8 to 16.5 volts.

Verify - To assess the operational characteristics of a R.A.D.A.R. unit, without any physical adjustments to the unit from a known standard.

Wave - Similar to waves in water, microwave energy also travels as waves. A wave is described by its amplitude and its period, or duration. On an oscilloscope, the wave is presented as a cyclical entity with amplitude on the vertical axis and time on the horizontal axis.

Wavelength - Wavelength is the measured length of a full cycle of a wave from its upward sweep through the downward sweep and back to its beginning level. The length of a wave depends on its frequency. Some examples are: a 155 megahertz wave is about 6 feet long, the X-band R.A.D.A.R. wave (10.525 gigahertz) is about 1.1 inches long, the K-band R.A.D.A.R. wave (24.150 gigahertz) is about .4 of an inch, and the Ka-band (33.4 gigahertz) is about .35 of an inch.

X-Band - The portion of the electromagnetic spectrum including 10,525,000,000 cycles per second, or 10.525 gigahertz, at which a class of police traffic R.A.D.A.R. operates.

X-Band R.A.D.A.R. - A speed measuring R.A.D.A.R. device designed to operate in the frequency band of 10,500 to 10,550 MHz .