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Speed Detection: LADAR

Basic Radar Devices

- RADAR - RAdio Detection And Ranging
- Radar measures reflected radio signals
- Uses Doppler Theory to detect frequency shift in reflected waves
- The greater the Doppler shift, the greater the speed

Early Radar Devices

- S - Band Radar : operates at 2 - 4 GHz - Microwave ovens operate at 2.45 GHz
- X - Band Radar : operates at 10.50-10.55 GHz - Not accurate below 20 mph, has interference problems
- K - Band Radar : operates at 24.05-24.25 GHz - Water Vapor absorption band centered at 22.24 GHz

Modern Speed Detection

- Ka - Band : operates at 33.4 - 36.0 GHz - has 13 200-MHz channels, can operate in "hop" mode
- Ladar : uses light emitted at 904 nm (typical)
- can use different wavelength, dependent upon material

The Technology of Ladar

- Ladar uses 3 semiconductor diodes to generate laser light
- Uses light pulses to make 2 consecutive distance measurements, then divides by time
- Lenses are used to collimate light to narrow beam
- Typically use ANSI Class I laser devices

Advantages of Radar

- Very flexible - can be used in a number of ways- Stationary mode, Moving mode, Two Directional mode
- Beam spread can incorporate many targets
- Can often select fastest target, or best reflection
- Still very reliable

Radar Disadvantages

- Time - Radar can take up to 2 seconds to lock on
- Radar has wide beam spread (50 ft diameter over 200 ft range)
- Cannot track if deceleration is greater than one mph/second
- Large targets close to radar can saturate receiver
- Hand-held modulation can falsify readings
- More interference sources

Ladar Advantages

- Faster lock-on time (less than 1/3 second)
- Very narrow beam spread (less than 6 ft over 2000 ft range)
- Better ability to track decelerating targets
- Typically mounted, and aimed with optical targeting device
- Fewer sources of interference
- Much more difficult to detect

Problems with Ladar

- Particles (dust, water) in air can limit range
- Rounded surfaces, the colors black, blue, and violet are poor reflectors
- Can be difficult to track target
- Alignment can cause severe error
- Extreme sunlight can be damaging