Radar Operator

LOS ANGELES COUNTY SHERIFF'S DEPARTMENT

R.A.D.A.R. OPERATOR COURSE (1820-23300)

I. Speed and Enforcement
   A. Speed in relation to traffic safety
      1. Relationship between speed and stopping distances.
      2. Relationship between speed and the severity of injuries sustained.
      3. Correlation between speed and the probability of having a collision.
   B. Speed Enforcement
      1. The benefits of an effective speed enforcement program.
      2. Types of speed offenses.
      3.

II. History and theory of police traffic radar
   A. Doppler principle
      1. Founder Christian Johann Doppler
      2. Definition
      3. Based on sound waves
      4. Examples
   B. R.A.D.A.R.
      1. Acronym
      2. Radio waves
      3. Detects relative motion
      4. Band identification (S,X,K,K_a)
   C. Radio waves
      1. Frequency
      2. Wave length
      3. Travel at the speed of light
   D. Doppler principle
      1. The difference between the transmitted and returned frequency

2. Caused by the relative motion of an object

3. Examples

E. Beam length is infinite unless:

1. Reflected

2. Refracted

3. Absorbed

I. Stationary radar operation

A. Radar beam

1. Shape and characteristics
2. Main beam
3. Beam axis
4. Zone of influence
5. Side lobes
6. Beam width

1. Beam range
2. Antenna position

B. Cosine angle

1. Define
2. Effect
3. Cosine error equation
4. Calculations

C. Components

1. Antenna(s)
2. Box (counting unit)
3. Current (power source)

D. Installation

1. Cable connections
2. Power up unit last
3. Unit should be turned off
4. Location in vehicle
5. Air bag caution

E. Testing
1. Internal circuitry test
2. Light segment test
3. External test (tuning fork)
4. When to test radar device

F. Audio Doppler
1. Significance of audio Doppler
2. Pitch
3. Clarity
4. Volume level
5. Unfiltered signal
6. Consistent with target window

G. Features / modes
1. Stationary mode
2. Target window
3. Switching between front and rear antennas
4. Anti-detection switch / hold button
5. Lock button / lock window

H. Circuitry diagram
1. Transmitted frequency
2. Received frequency
3. Mixer diode
4. Filter
5. Time base counter
6. Verifiers
7. Target window readout

A. Tracking history

II. Moving radar operation
A. Radar beam
1. Shape and characteristics
2. Main beam
3. Beam axis
4. Zone of influence
5. Side lobes
6. Beam width
7. Beam range
8. Antenna position

9. Basic moving radar equation
10. Moving radar opposite direction

B. Cosine angle
1. Define
2. Effect
3. Moving radar cosine error formula
4. Calulations

C. Components
1. Antenna(s)
2. Box (counting unit)
3. Current (power source

D. Installation
1. Cable connections
2. Unit should be turned off
3. Location / position in vehicle
4. Power up unit last

E. Testing
1. Internal circuitry test
2. Light segment test
3. External test (tuning forks)
4. When to test radar device

F. Audio Doppler
1. Significance of audio Doppler
2. Pitch
3. Clarity
4. Volume level
5. Unfiltered signal
6. Consistent with Target window

G. Features / modes
1. Moving mode
2. Target window
3. Patrol window
4. Anti-detection switch / hold button
5. Lock button / lock window
6. Switching between front and rear antennas

1. Same direction

2. Faster / slower

B. Circuitry diagram
1. Transmitted frequency
2. Received frequency
3. Mixer diode
4. High pass filter
5. Low pass filter
6. Time base counter
7. Verifiers
8. Patrol window readout
9. Subtraction of low Doppler from high Doppler
10. Target window readout

C. Double cosine effect
1. Cause
2. Effect
3. Low Doppler
4. High Doppler
5. Moving radar double cosine error equation
6. Calculations
7. Detection / elimination

D. Shadowing effect
1. Cause
2. Effect
3. Low Doppler
4. High Doppler
5. Moving radar shadowing error equation
6. Calculations
7. Detection / elimination

E. Moving radar same direction
1. Add or subtract relative motion
2. Target faster mode
3. Target slower mode

F. Tracking history

I. Radar effects
A. External mechanical interference (EMI)
1. Caused by moving objects
2. Avoidance / elimination

B. Random radio frequency interference (RFI)
   1. Internal interference
   2. External interference
   3. Avoidance / elimination

A. Harmonic signal interference
   1. A multiple of a base frequency
   2. Causes
   3. Avoidance / elimination

B. Own speed capture effect
   1. Applies only to moving radar mode
   2. Simultaneous display
   3. Caused by multiple reflections
   4. Avoidance / elimination

C. Pulsating signal amplitude effect
   1. Applies only to moving radar mode
   2. Caused by irregular surfaces
   3. Avoidance / elimination

D. Feedback / scanning
   1. Possible only with two piece equipment
   2. Caused by improper installation or use
   3. Avoidance / elimination

E. Audio effect
   1. Caused by extremely loud radio
   2. Avoidance / elimination

F. Antenna vibration effect
   1. Caused by movement of antenna
   2. Avoidance / elimination

G. Dented antenna horn effect
   1. Causes a distorted beam
   2. Avoidance / elimination

H. Windshield obstruction effect

1. Reduced range
2. Distorted signal
3. Avoidance / elimination

A. Beam reflection effect
1. Caused by reflective surface
2. Reads speeds from opposite direction
3. Avoidance / elimination

J. Weather effects
1. Rain or snow reduces range
2. Low Doppler pick up difficult
3. Avoidance / elimination

K. Heat build-up effect
1. Causes component values to change
2. Causes circuitry damage
3. Avoidance / elimination

AX. Power surge effect
1. Occurs when power is first turned on
2. Avoidance / elimination

A. Automatic gain control
1. Increases sensitivity
2. Avoidance / elimination

B. Panning effect
1. Caused by sweeping motion of antenna
2. Avoidance / elimination

C. Batching effect
1. Caused by a rapid change in the patrol vehicle speed
2. Avoidance / elimination

D. Multi-path signal effect
1. Caused by a reflected signal
2. Avoidance / elimination

I. Legal aspects of speed enforcement
A. Court decisions
1. National case law

2. California case law

B. Federal regulations related to radar
1. Federal Communications Commission (FCC) license not required by operator
2. Nation Highway Traffic Safety Administration (NHSTA) set minimum standards for radar training
3. Radar must be accepted type approved by the International Association of Chiefs of Police (IACP)

I. Vehicle code law
A. Speed offenses
1. Section 22348
2. Section 22349
3. Section 22350
4. Section 22356
5. Section 22400
6. Section 22406
7. Section 22406.1

B. Speed traps
1. Speed trap prohibition-Section 40801 C.V.C.
2. Speed trap defined-Section 40802 C.V.C.
3. Speed trap evidence-Section 40803 C.V.C.

C. Speed surveys
1. Defined by California Vehicle Code- Section 627 C.V.C.
2. Criteria for determining speed limits in surveys
3. State Traffic Manual sets guidelines
4. Define 85^{th} percentile / critical speed

1. Discuss when speed surveys are required
2. Prima facie speed limits- Section 22352 C.V.C.
3. Discuss who conducts speed surveys

B. Radar detectors
1. Radio receivers
2. Potential effectiveness
3. Defeat of detectors
4. State laws restricting detectors

C. Radar jammers
1. Radio transmitter

2. Federal Communications Commission (FCC) regulations
3. State law
4. Detection of radar jammers
5. Law enforcement response to potential violators

I. Radar evidence
   A. Subpoena duces tecum
      1. Define
      2. Application to radar
   B. Documents
      1. Certification of operator
      2. Vehicle speedometer calibration
      3. Vehicle maintenance record
      4. Departmental FCC licensing for radar devices
      5. Radar operator's manual
      6. Radar certification
      7. Tuning fork certification
      8. Radar maintenance record
      9. Officer's daily activity log

I. Practical exercises and testing
   A. Introduction
      1. Safety rules
      2. Testing procedures
      3. Supervise speed estimate practice and testing
      4. Review of project work exercises
   B. Speed estimate practice
      1. Stationary
      2. Moving
   C. Speed estimate testing
      1. Stationary
      2. Moving

I. Courtroom testimony
   A. Techniques of effective courtroom testimony
      1. Advance preparation

1. Proper dress
2. Proper demeanor

B. Considerations for radar case examination
1. Officer's qualifications
2. Knowledge of related California vehicle code law
3. Knowledge of equipment
4. Knowledge of principles
5. Knowledge of beam width and range
6. Knowledge of radar effects
7. Application of tracking history
8. Target determination

I. Written examination
A. Multiple choice
B. Calculations