

Common Traffic Radar Operator Errors

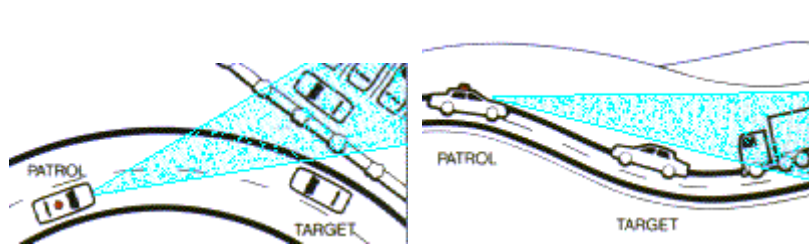
While Federal standards for traffic radar were proposed in the past, they have never been implemented. However, in an attempt to reduce radar errors, several local governments used the Federal research to develop better training programs.

The Texas Department of Public Safety produced a comprehensive manual based on the Federal tests. It cautions operators, "...the radar does not generate 'false' readings. Any time a reading appears, the radar has sensed a signal. The radar operator must be familiar with situations that can produce 'error' readings." If the operator does not detect the error, a ticket will be wrongfully issued.

Here are the radar "errors" detailed by the Texas manual:

1. Antenna Positioning Error

The radar beam travels in a straight line, neither bending around curves nor following the contour of hilly terrain. If the antenna is not properly positioned, it may seem to clock an approaching car when, in fact, it's clocking another car in the background.



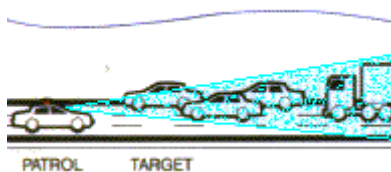
2. Look-Past Error

Even if the operator aims his antenna properly, radar is still subject to "look-past" error. This is caused by the radar looking past a small reflection in the foreground to read a larger reflection behind. This error is all the more insidious because poorly-trained operators assume it can't happen.

Texas instructors warn, "It is a widely-held misconception that the reflected target signal received by the radar antenna will always be that of the closest vehicle to the antenna. There are times, due to traffic conditions, that the closest vehicle is not returning the strongest signal."

Evidence of the potential size of this error appeared in Car and Driver (October, 1979). The author measured the effective range of a Kustom Signals KR11 traffic radar against various vehicles. The typical small sedan did not show up on the radar until it was less than 1200 feet away from the antenna, but the same radar unit locked on to a Ford 9000 semi at 7600 feet. This shows how common vehicles reflect microwaves differently.

The Texas instructors confirm this problem with radar, saying "It is not unfair to say that the reading you register could be a larger, better target three-quarters of a mile down the road."

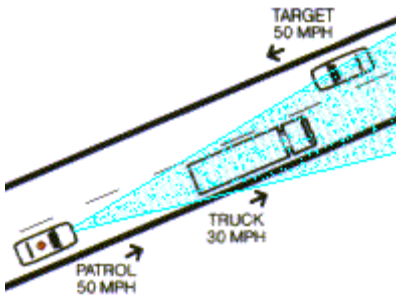


3. Vehicle Interference Error

Because moving radar tries to do a more complicated jog than stationary radar, it is subject to all the errors of stationary radar, plus several additional errors that apply to it alone.

"Vehicle interference" error occurs when moving radar is used in traffic. For example, traffic ahead can confuse the radar's estimate of patrol speed. Moving radar calculates target speed by subtracting patrol speed from the closing speed of the target. Therefore, anything that produces a low evaluation of patrol speed will automatically result in a high speed reading of target speed.

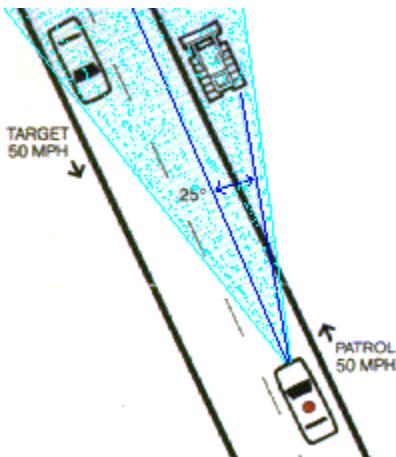
Texas tells its radar operators that this "...situation becomes more critical if difference in patrol speed and interference-vehicle speed is five to ten mph. A target vehicle moving 61 mph may be recorded at 66-71. These borderline speeds are more difficult to detect with the eye."



4. Cosine Error

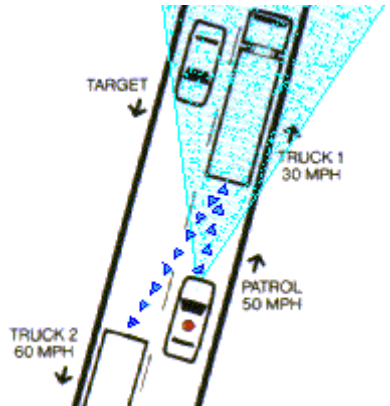
Cosine error produces a result similar to Interference error except no moving traffic need be present. A stationary object adjacent to the road, such as a building, or road machinery, or even a sign, makes a more efficient reflector than horizontal pavement. Therefore the radar uses that reflection as the basis of patrol speed.

If this reflector were positioned straight ahead on a collision path, the patrol speed estimate would be close enough. But the further the object is located off a direct line to the target, the lower will be the estimate of patrol speed. This is a simple trigonometry problem relating to the cosine of the angle between the target and the ground reflector, hence the name Cosine error. Since Cosine error always makes patrol speed seem smaller than it actually is, it always acts to raise the reading of target speed.



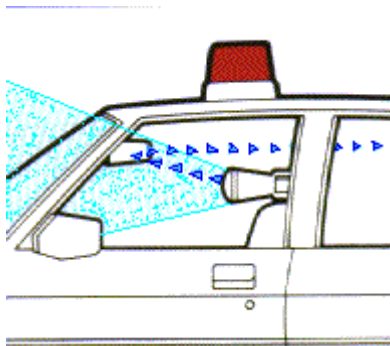
5. Double-Bounce Error

Microwaves are easily reflected. That's what makes radar possible. But the operator must be aware of the difference between an ordinary reflection and a bad bounce. Big objects such as trucks are very efficient reflectors, and it's possible for the radar beam to bounce off several moving trucks at once, always producing erroneous readings.



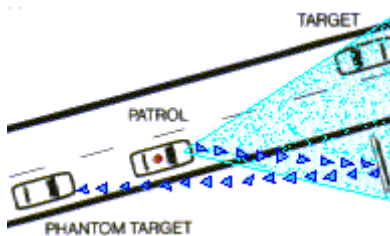
6. Beam-Reflection error

Because microwaves are so readily reflected, Texas instructors recommend caution, even in mounting the antenna within the patrol car. They say it's possible that a reflective path can be set up through the rearview mirror that will produce radar readings on vehicles behind the patrol car when the radar is aimed forward. And those vehicles behind can be either coming or going, since radar does not distinguish directions.



7. Road-sign error

The ready reflectability of microwaves means that road signs are also source of errors.



8. Radio-Interference Error

According to the Texas course, "UHF radio now in use can force radar to read various numbers when you transmit, or just key the mike. Citizens band radio transmissions from within the patrol vehicle can cause ghosting (false readings)." It recommends that no radio transmissions be made while clocking target vehicles.

9. Fan-Interference error

When the antenna is mounted inside the patrol car, the Texas course says, "Radar will have a tendency to read the pulse of the fan motor (air conditioner, heater, or defroster)." The instructors go on to say, however, that the fan reading will disappear when a target comes into range, and that the fan will not distort the speed reading of the target car.

However, in the case of moving radar, they say, "Sometimes a steady fan speed will override patrol car speed reflected from the roadway." When this happens, the false speed reading produced by the fan will be substituted for patrol speed in the moving radar's calculation of target speed. Since the calculation consists of subtracting patrol speed from closing speed, if the fan reading is less than patrol speed, then the speed displayed for the target will be incorrectly high. The Texas course offers no safeguard for this error.

In conclusion, the Texas Department of Public Safety notes "Radar cannot identify (the) speeding vehicle: (the) officer must do that."

Why Traffic Radar Gets Wrong Readings

The greatest weakness of traffic radar is the way in which it gives its information. It has only one readout and it displays only one number. You can point the radar antenna down a two-lane road with traffic going in both directions. Vehicles can range in size from economy cars to semi trucks. And all the radar will show is one number.

Where does it get its one number? And how can the operator know which of the coming and going vehicles is responsible?

The truth is, often the operator cannot know for sure. He has to guess. This is the most serious of all of traffic radar's limitations. Because it's made to a low-bid price, it must necessarily be a relatively simple device. Without the modulated beam of military radar, traffic radar cannot distinguish between targets within range. Without the radar screen, it cannot identify for the operator which target it's reading.

At least the low power of traffic radar is an asset here in that it limits surveillance to line of sight.

Guessing The Offender

To make up for the lack of a modulated beam and the absence of a radar screen, traffic radar makers use the cheapest imaginable substitute. They simply program the electronics to disregard all but the strongest reflection in the case of stationary radar, all but the two strongest reflections in the case of moving radar. This is the method of all traffic radars. The number displayed on the readout comes from this simplification. It's up to the operator to decide which - if any - of the moving vehicles within range is producing the unseen reflection. If there is only one vehicle in range, probably that vehicle is responsible for the number, although it could be caused by an electrical interference or blowing trash or some other less obvious distraction to the microwaves.

If there is more than one vehicle in range, it's up to the operator to decide which one is producing the reflection. Is it the closest one to the antenna, or is it the largest one in the pack? In truth, it could be

either, depending upon a host of subtleties.

A skilled operator intent on justice wouldn't write a ticket unless he was absolutely sure. A less skilled operator might write the ticket thinking he had the right answer, and be wrong. A careless operator intent on filling his quota might see the number and single out a likely perpetrator - the red sports car - and be done with it. When you deal with humans, you take your chances.

Because traffic radar is built to a low-cost target, it is not the infallible electronic instrument that it purports to be. And because operators have a tough time keeping track of invisible beams, traffic radar invites human error in vehicle identification.

No Government Standards

While military radar is produced to exact government standards to assure accuracy, traffic radar is not subject to any government standards whatsoever. In the late 1970's there was wide-spread publicity about radar error including a tree that was "clocked" at 86-mph. The National Highway Traffic Safety Administration (NHTSA) assigned to the National Bureau of Standards the task of testing all brands of traffic radar in use at the time, for the purpose of discovering the source of these errors and proposing federal standards to eliminate them. In January 1981, these proposed standards were published in the Federal Register. The newly-installed Reagan administration took no action on the proposal.

After three years of government inaction on the problem, the International Association of Chiefs of Police (IACP) provided non-government standards by which all traffic radar units could be tested to assure accuracy: Volume I of the standards was published in April, 1984, Volume II in June, 1984.

In June 1986, the traffic-radar manufacturers announced the formation of their own trade association, saying that they would not submit traffic radar units for IACP testing. *Instead, the radar makers would use their own standards.*

These industry standards have not been published thus far. So, in effect, there are no performance requirements for traffic radar, and the claims of 86-mph trees and 28-mph house have never been refuted.