

DRIVER'S GUIDE TO

Police Radar

Everything You Need to Know About Speed Enforcement



World-renowned radar expert **Craig Peterson** reveals:

- How Police Use Radar and Lasers To Clock Your Speed
- Where Radars and Lasers Are Used
- Common Radar Mistakes
- New Undetectable Digital Super-Radars
- Radar Detectors and Electronic Countermeasures
- How To Pick the Right Radar Detector
- Top 10 Secrets to Getting the Most From Your Radar Detector
- **Exclusive Features!**
 - *Field Test Report of the Most-Widely Used Police Radars*
 - *Specifications and Features of Every Police Radar and Laser Gun*

Craig Peterson

Author of *Fast Driving (Without Tickets)*

Driver's Guide to Police Radar

by Craig Peterson

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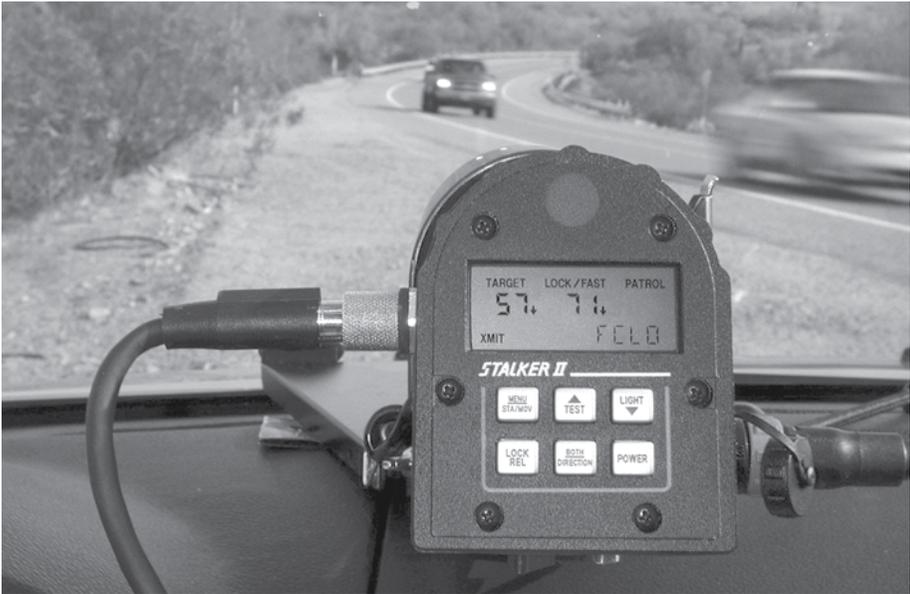
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CHAPTER 2

Radar 101, the Basics

Radar is fairly complex technology and very few people have more than a fundamental grasp of how it works. If that includes you, don't sweat it. Even cops aren't required to know the scientific principals behind the stuff; they're only required to know how it works. And that's the subject of the next few chapters.

Some drivers understand that radar involves reflected radio waves, but they remain clueless about how that is applied to speed measurement. Check the Internet sometime—newsgroups in particular—and you'll be dazzled by the amount of information on radar that's being bandied about. Most of it's wrong, sometimes laughably so.

For example, many believe it can be used from aircraft. (It can't.) Some believe that radar can read the speed of a car moving at a 90-degree angle to the radar. (Impossible.) Others think that placing wads of aluminum foil inside their wheel covers or dangling bits of chain from under the bumper can confuse radar. (Wrong again.) Still others think that for less than three C-notes they can buy a radar jammer that can stymie radar. (Forget it.)



Any traffic officer can pull over some poor clown and tell him he'd just been clocked using a Chingadera 390-model radar operating in Full Waffle Mode. The guy would probably believe it. I mean, how is he supposed to know any different? Even an unfortunate number of cops are surprisingly ignorant about radar's true capabilities.

One New Year's day I was stopped by a local traffic officer. I had driven past his parked cruiser, hunkered down on the far side of an urban freeway overpass. Although well under the legal speed at that point, I routinely monitored the mirrors as I drove away. I was driving a bright red DeTomaso Pantera, a car any cop takes a hard look at, and it seemed wise to keep abreast of any developments. At first it looked like he was ignoring me. But an instant before he disappeared from the mirrors I saw him pull out behind me.

I was returning from an all-night party, my head hurt and I didn't want my day complicated by the fuzz. So I resolved to behave myself. Settling into a slow canter in the middle lane, I joined the mass of other good citizens shuffling along, many of them probably as hung over as I was, judging from their erratic driving.

About a mile back I could see a car abruptly changing lanes, getting around slower traffic, as he slowly closed the gap. It didn't take a degree in astrophysics to know I was watching my man force his way through traffic to catch up. Since he was running without having switched on his overheads (cop-speak for light bar), I surmised that he hadn't seen a violation and couldn't justify "running hot" as they say, using his red-and-blue emergency lights.

Moments later, my radar detector shrilled a warning. I ignored it. Sitting in the middle of four lanes of solid traffic, flanked by half a dozen other vehicles, some of them barn-sized Texas Cadillacs (Suburbans and Escalades), there was no way radar was going to see my slinky, knee-high sports car. (A laser could, though.)

The more sophisticated radars can single out one target from a pack of vehicles—but only if it's the fastest one, and then only under certain circumstances. Surrounded by larger vehicles moving at the same speed, my mid-engine Italian hotrod was invisible to radar. So, regardless of the apparent presence of another radar unit, I figured the more pressing problem was the cruiser sprinting up from behind.



I backed off slightly when he approached to within a quarter mile, letting him close in. He came up to within about three car lengths, then fell in behind me. If he was observing procedure, I knew he'd be running the license plate, in police jargon requesting a 10-28 - 10-29, asking the dispatcher to check whether there were any wants or warrants out on it. Then there was a burst of reds and blues from his light bar, ending the cat-and-mouse routine.

Like most traffic stops, this one started with a request for license, proof of insurance and registration. All were okay. I waited for his next move; it was his show. Mainly I wanted to see what he'd come up with as probable cause for having stopped me. Finally he got around to the subject.

“Running a little fast back there weren't you?” he began. If you're smart, you don't tell a police officer he's wrong. Wearing a uniform, packing a badge and a gun, there is no way he's going to lose an argument. The recommended etiquette: Try to be diplomatic.

“Tell you the truth, I'm trying to behave myself this morning. I was at a pretty wild party last night, my reactions are a little slow and I'm not in any particular hurry anyway. Not that I always drive this way. Normally I'd a been running a little faster.”

He looked at me speculatively. “I think you were runnin' a little fast right back there,” he suggested.

I smiled. “Come on, I'm not stupid, I saw you pull out after me. I wasn't about to do anything dumb with you back there.”

He shook his head. “I let you get out of sight before I pulled out.”

“I saw you make your move just before I went over the top of the overpass. Even if I hadn't, you were pretty obvious, cutting through traffic like that. Would've been tough to miss you, even with a hangover.”

For a moment he looked crestfallen. Then his face brightened. “Motor officer back there on the access road says he got you at 68 on radar.”





☛))) Decatur GVP-D cordless K-band held-held radar features directional operation and Fastest Speed capability.

Okay, now I knew what was happening. There may well have been a motorcycle unit back there—my detector had gone off—but there was no way on Earth he could have shot through several lanes of traffic to single out my car. If this guy had been out of the police academy more than six months, he'd know that. He just wasn't aware that I knew it too. Civilians aren't supposed to know about radar. I glanced at his patrol car in my mirror. A Kustom Signals KR-10 moving radar sat on the dash. I have one just like it.

Now I knew why he was stopping me. He knew perfectly well his buddy hadn't clocked my speed. He just wanted to check out the Pantera, not an uncommon occurrence. So I got him talking about cars.

As it turned out, he had an older-model Porsche. He asked about the Pantera's top speed, which I told him (176 mph at 7000 rpm in top gear, if it matters). He seemed impressed but was discrete enough not to ask how I'd acquired that bit of information. After ten minutes spent chatting about cars and driving, he turned me loose. Without a ticket.

Radar comes in two flavors, *stationary* and *moving*. Moving radar can operate in either stationary or moving mode. (In the aforementioned episode, the officer was using moving radar, but he had placed it in stationary mode while parked.)

The most common type of stationary radar—so named because it must be used from a stationary position—is the hand-held radar gun. These are most often found in town where target range is short, generally less than 600 feet, and traffic density makes moving-mode operation difficult or impossible.

The tool of choice for state police—and what you'll find on every interstate in the nation except for Pennsylvania—is moving radar. In the

Freedom State, some truly weird statutes allow radar to be used only by the State Police and it must be used only in stationary mode. So while the PSP does have some 1,200-odd radar units, they're all hand-held models used exclusively from the roadside. What's the big difference between stationary- and moving-mode operation? Quite a bit, actually.

Radar operating in stationary mode means the officer using it must be parked. With limited manpower and resources, sheriff's departments—and highway patrols in particular—demand mobility. Although upward of 80 percent of the moving violations they write are for speeding, they're also responsible for working wrecks and investigating accidents. This means they can't be spending long hours doing nothing but working speed enforcement. So their preferred hardware is moving radar, letting them work speed while on routine patrol.

Stationary radar only has to track the speed of a target, not the target's plus the patrol car's, which is the case with moving radar. With stationary operation, since the radar itself isn't moving, the task of making speed calculations is simplified.

Moving radar was invented by Kustom Signals in 1972 and uses something called High Doppler and Low Doppler. The latter refers to the portion of the elliptically-shaped radar beam that reflects back to the antenna from the road surface, telling it how fast the patrol car is traveling. High Doppler is the reflection from targets in the main part of the beam.

To compute the speed of an oncoming target, the radar adds *Patrol Speed* (low Doppler) to *Target Speed* (high Doppler) to establish *Closing Speed*, the combined speeds of the cruiser and the target vehicle. Then it subtracts Patrol speed from Closing Speed to determine target speed.

Here's a simplified version of the formula:

$$\text{Closing Speed} - \text{Patrol Speed} = \text{Target Speed}$$

For example, let's say a speeding southbound car approaches a northbound police cruiser on an interstate. The radar sees a closing speed of 145 mph. It subtracts the cruiser's 65 mph speed and displays the car's speed as 80 mph. Under optimal conditions, from the time the officer triggers his radar to the time a target speed appears on the radar, we're talking well under one second.

My company, Radartest.com, for years has been retained by radar manufacturers to conduct performance tests of their new models.





📡))) In this classic moving mode/opposite lane confrontation an officer using the instant-on feature has an almost unbeatable edge over the oncoming violator.

Sometimes they request a comparison test, to see how the new radar stacks up against the competition. In one such comparison of all four frontline DSP moving radars, a test was designed to determine how quickly they could get a speed on a target car from varying distances.

With radar vehicle parked at roadside, the target car—a Ford Fusion, chosen because of its smallish radar cross section, which made it a mediocre radar target—began its runs toward the radar from a staging area some 4,000 feet away. Moving at 20 mph, as the driver passed a traffic cone placed exactly 3,000 feet from the radar, he'd call the radar operator on the UHF radio, who in turn would trigger the radar. The same test

was also carried out from 1,500 feet. These two distances represented longer-than-normal target ranges, but the idea was to explore each radar's maximum performance envelope.

The test requirement was:

1. Release RF Hold and transmit (one button-press)
2. Observe target speed and listen for audio Doppler confirmation
3. Lock target speed (a second button-press)

What we found was that all of the radars would produce nearly instantaneous target speeds, well under 0.15 second. The most time-consuming part of the process was glancing at the Target Speed display to verify an accurate speed, then pressing the Lock button. Since some of the remotes had Lock placed in a less-than-optimal position, requir-



ing a long reach from one button to the next, total elapsed time for the three-step sequence was limited only by how fast the operator could shift his thumb from the XMT (transmit) button to the Lock button, an average of 0.45 second for all four units. But the radar itself was far quicker than that.

So while radar can easily get a target speed in an eye blink—the MPH BEE III radar used in POP mode can accomplish this in 33 milliseconds or 33 one-thousandths of a second—this number only reflects what the radar itself can do, and that under ideal conditions. Using the radar properly involves taking some additional steps and requires much more time.

There are two reasons why radar's practical speed is far different from its theoretical speed in acquiring targets. One, *radar is dumb*. It simply displays a speed, leaving it up to the officer to determine which vehicle it's looking at. Until 1994 all U.S.-made radar showed the speed of the strongest target. If only one target was in range, no problem. If there were several, the closest one usually was the strongest. But not always.

Here's an example: Say a large truck is 500 feet from the radar and an Acura coupe is 400 feet away. Whose speed will the radar see: A) the truck or, B) the closer Acura? The correct answer is (A). That's because the truck has upward of six times the frontal area of the little Acura and though farther away, it presents a stronger return signal to the radar. For this reason, radar case law, landmark legal precedents established over the decades since police radar's debut, makes some demands of the officer.

For example, in moving-mode operation, before stopping and citing a driver for speeding he's first required to:

1. *Observe the violation*—speed in excess of the posted limit, in this instance. To do this he has to estimate the speed. How tough is this? Next time you're cruising down an Interstate, try looking 1,000 feet down the road. (Other than in the cramped north-eastern states, that's roughly the distance from under a freeway overpass to where the on-ramp merges with the right lane.) Pick any oncoming vehicle. Within three seconds can you accurately gauge its speed? Not the exact number but, say, within five mph?

Forget about it. For civilians, unless they're clairvoyant, it's a waste of time. But while any competent, experienced traffic officer can visually estimate speeds with an accuracy tolerance



of plus or minus 3 mph, most can't do so at extreme range. If the target is coming directly toward him, the job is even tougher, due to the lack of apparent motion.

Estimating speeds of opposite-lane targets on a divided highway is a bit easier. In this situation the officer is off-angle, allowing him to observe how quickly the vehicle is passing fixed objects, greatly assisting in determining its speed. But even with the extra help afforded by the better view, it's impossible to accurately estimate speeds at long range.

For this reason, when monitoring oncoming cars, most officers allow a target to approach within about 700 to 800 feet before hitting it with radar. This applies even to the lazy ones who ignore procedure and simply fire at any vehicle of interest without bothering to make a visual speed estimate first.

2. *Identify the target.* Reading the license plate isn't necessary but making out the size, type of vehicle, color and its lane position is required. On an empty road, this is a no-brainer. But if two or more targets are near one another and moving at roughly the same speed, the officer must zero-in on his selected target and keep track of it.

There's one more purpose for noting the vehicle's physical characteristics. Once he's got a target speed, the officer will need to U-turn and catch the guy. On a busy road, particularly at night, this isn't as easy as it sounds. Especially if the target is, say, a five-year-old, gray Honda Accord, one of the ultimate stealth cars due to the sheer number of such vehicles. There's been more than one instance where the wrong Honda Accord has been pulled over.

3. Once the radar is triggered and a target speed appears, the officer should *compare it to his visual estimate* and to the pitch of the audio Doppler, a tone generated by the return signal whose pitch varies in proportion to target speed. When the target passes out of the radar beam or when the beam shifts to another target traveling at a different speed, target speed and audio Doppler will change in unison.

🗨️)) We'll take a closer look at known radar errors like this in Chapter Six, "Common Radar Mistakes".

In moving mode, this should be done even if there's only one car within range.



It serves as a safeguard against several types of radar errors (see Step 4).

4. He also must compare the radar's patrol-speed reading with the car's certified speedometer, making sure they're the same. This guards against an error common to moving radar called *shadowing*. Net effect: target speed is artificially inflated.
5. During this time the officer should be listening to the radar's audio Doppler. This high-pitched tone varies in proportion to target speed and helps to identify the target. The tone should remain steady while the radar samples a target speed that's constant.
6. During this time the officer is expected to be listening to the radar's audio Doppler. The frequency of this high-pitched tone varies in proportion to target speed and by comparing the tone to his visual estimate of the target's speed, a mismatch will indicate that the radar and officer are looking at different cars. It's torture to listen to audio Doppler—it sounds a lot like fingernails being raked across a chalk board—but it's there for a reason. Still, a lot of officers find it a nuisance and turn it off.
7. Next he should monitor target speed for a few moments, making sure it remains fairly constant. If the number takes a nosedive, it usually means the guy's packing a detector and just spiked the brakes, or maybe he just awoke from his slumber and finally noticed the police car. But another reason could be that the radar beam has already shifted to another vehicle. This can happen instantaneously. By observing both target and target speed for a period of time, the officer is establishing a *tracking history*, absolutely essential—particularly in moving-mode—to keep the officer from accidentally citing the wrong driver.
8. Satisfied with target ID and the speed, now the officer can take enforcement action. That's cop-speak for making a traffic stop and issuing a warning or a citation.

If your eyes are a bit glazed-over now, just try to remember that the most common encounter you can expect to have with *moving* radar is as simple as 1-2-3.

1. You meet a police car coming from the opposite direction.



2. The police car passes by, U-turns and pulls up behind you, light bar aglow.
3. Moments later a gent wearing a uniform, badge, handcuffs and sidearm is asking to see your driver's license, registration and proof of insurance.

In the trade, this is known as being nailed by radar operating in *Moving Mode/Opposite Lane*, by far the most common moving-radar encounter. At Radartest.com I'm continually getting e-mail from distraught drivers who've just received a ticket. Most describe an encounter exactly

☛ See Chapter 9 to find out more about Same Direction mode. Fastest Speed mode will be looked at more closely in Chapter 4.

as I've described above. But although moving radar been around for over 35 years, many people have absolutely no clue that such radar exists.

Nearly all moving radar models can be fitted with front and rear antennas. State highway patrol cars increasingly make use of this setup. The payoff is enhanced capability, since it allows them to not only check oncoming opposite-lane cars but also, using the rear antenna, to monitor opposite-lane cars once they've passed the police vehicle, heading away. Some exceptionally conscientious officers often use both antennas on a target, giving them an extra-long tracking history. But ordinarily, the rear antenna isn't often used in moving mode unless for some reason the officer can't take care of business with the front one alone.

Naturally there are exceptions to this. Some officers make frequent use of Same Direction mode. And a very special radar, the Stalker DSR 2X, can simultaneously track multiple vehicles both ahead of and behind the rolling cruiser.

Radar doesn't have the magical qualities most drivers assume. As I said, conventional radar can't pick a single, fast-moving car out of a pack. But radar with *Fastest Speed* can.

Radar is designed to read the strongest signal, which, if all the targets have roughly the same *radar cross section*—the amount of reflective frontal area—will usually be the closest target. But this is not always the case.

Signal strength is calculated by the radar by taking into account



several criteria. Relative target range is a major factor in deciding which vehicle's speed will be displayed. If multiple targets of roughly equal size are within range, radar will almost always read the closest one, simply because its return signal will be strongest. But that isn't true when very large vehicles—trucks in particular—are mixed in with cars. In this instance the radar will continue tracking the big rig until the car is nearly on top of the radar. If the two vehicles stay near to one another, it's very likely the car will be ignored entirely.

After well over two decades of testing police radar units, I can guarantee that regardless of manufacturer or model, any radar has pretty much the same affinity for target type. Here's what they like, in descending order of attractiveness:

1. Eighteen-wheeler cab-over
2. Single- or double-axle straight truck
3. Pickup truck with camper
4. Full-size van, pickup and sport-utility vehicle
5. Mini-van, mid-size SUV
6. Full-size and mid-size sedans, CUVs
7. Compact cars, sport coupes
8. Corvette, Miata, Solstice, most sports cars; all cars with non-metallic bodywork
9. Motorcycles
10. Bicycles (yes, radar will read pedal-powered devices, too. While testing radar at one of our desert sites, very popular with cyclists, we frequently track them from hundreds of feet away. But only if no bigger targets are within range.)

Frontal area—a vehicle's radar cross section—is the second most important factor. Radar loves vertical metal surfaces. There is a direct correlation between return-signal strength and the number of square feet of metal offered by the target. A cab-over tractor pulling a cargo trailer presents upward of 85 square feet of surface area. To a radar, it's like looking at the side of a barn. The back of the trailer is an even better target. In field tests of the leading radar units I've tracked a rig like this beyond 4 ½ miles. When the target speed disappeared, only by using binoculars could I see that it had turned off the road.



One thing to remember is that radar range, the distance at which it can reach out and touch you, is actually two different numbers. First is *maximum* target range. Second is *practical* range. There's a huge difference between the two.

When the Stalker Dual SL was introduced—it's arguably the best moving radar on the planet—I stopped by the company's headquarters in suburban Dallas. I was producing a video on the latest speed-measuring equipment and the Dual SL was to be included. The stop was to pick up one of the first production units for the video shoot, also to test and evaluate it for a story I was writing for *Law & Order* magazine.

I was driving a new police Camaro provided by Chevrolet's police vehicle program manager Bob Hapiak. Bob and co-manager Earl Gautsche are the two men who made Chevrolet's police vehicle program the most successful in the country for over two decades.

This particular vehicle was one of a handful of Z-28 models with Option Code B4C—the *special service package* or police version—built that year with a six-speed manual transmission. (There was no performance advantage over the four-speed autobox; like many race-car drivers I just prefer the extra control afforded by a manual transmission.)

It was destined to be outfitted with an endless array of high-tech hardware—mobile video recording system, the latest in radar, a radar detector-detector, a Federal Premium Vision seven-pod, programmable light bar and about a gigawatt's-worth of red and blue police strobe lights. Then I had a talented graphic artist design a knockout set of custom graphics for the car. (They made the car so visually arresting that when we displayed the car at police conventions also attended by Chevrolet, more attendees came to see our Camaro than theirs.)

On behalf of consulting clients, over the next two years we displayed this tricked-out show car at national conventions and exhibitions. These included the giant Consumer Electronics Show in Las Vegas, the second-largest trade show in the nation, and the International Association of Chiefs of Police—its equivalent in the law enforcement world—to make it the most widely recognized police vehicle in the country. It also appeared on "Good Morning America" and half a dozen other television shows, not to mention all of the major law enforcement trade magazines and several car-enthusiast books. On this particular trip I was driving it home from Detroit, having just taken delivery.



Stalker Radar president Alan Mead, one of the sharpest radar guys in the business, spent over an hour in the company parking lot with me, getting the twin antennas and other components fitted to the cramped interior. After trying different locations for the front antenna, trying to minimize fan noise (interference generated by the HVAC system, common in all police vehicles), we mounted it at the base of the left A-pillar. After doing a tuning fork test on both antennas, I departed for my home in Denver.

Darkness fell as I was heading north on Highway 287 out of Amarillo, a charming little town that's memorable chiefly by the unforgettable stench emanating from its abundance of cattle feedlots. Mid-week traffic was light up in the Texas Panhandle, allowing a perfect opportunity to check the Stalker's maximum target range. Placing the unit in moving/opposite mode, using the front antenna to monitor oncoming, opposite-lane targets, I began experimenting. It was soon clear that the Dual SL could easily reach out a mile or more to tag a mid-sized car.

Then ghost readings (target speeds displayed in the absence of a legitimate target) began to appear. At least they seemed like ghost readings. For example, a 68 mph target speed would flicker on the digital display, linger for a few moments, then disappear. Strangely, the radar's audio Doppler confirmed that it was a legitimate target.

But there wasn't a vehicle to be seen. Presently there would be the dim glow of headlights on the horizon and eventually, a tractor-trailer would pop into view and rumble past. This scenario was repeated several times until it was apparent that the Stalker was picking up the very tops of these 18-wheelers' trailers—at ranges so extreme that their headlights had yet to appear over slight rises in the road.

It seemed surreal that the radar was targeting vehicles almost over the horizon, so I decided to check target range. To do this I slowed to 75 mph, equivalent to 110 feet per second and, using the stopwatch feature on my wristwatch, recorded the elapsed time from the initial appearance of target speeds until the trucks passed by. Adding my speed to the target speed to create the combined or closing speed, I converted closing speed to feet per second, multiplied it by the elapsed time and calculated the average range. It was two miles.

This kind of range is little more than a conversation point in the real world, due to the limitations on radar operation imposed by the courts and by training guidelines. But for a radar geek at least, it



was pretty impressive. (During a later photo shoot this ultra-sensitive radar clocked a meadowlark flying nearby at 45 mph. The bird wasn't ticketed.)

Radar also has an affinity for flat, vertical bumpers, grilles, radiator supports and their brackets. Nearly all cars with fiberglass bodies make lousy targets because microwaves will not reflect from the material. It will penetrate it just like auto glass, but a return signal will be generated only by the metal behind the fiberglass. For this reason most Corvettes, especially Stingrays through the C5 platform, are difficult targets for radar. These fortunate Chevrolets are also blessed with retractable headlights, non-metallic grilles and, in some model years, radiators tilted back several degrees from the vertical.

Radar loves headlights. Retractable headlights don't offer themselves as targets. But exposed headlights certainly do. Their reflectors take the incoming beam, concentrate it nicely and send it back directly toward the radar. Late-model, computer-designed headlight reflectors make terrific targets. A license plate is equally attractive to radar.

Non-metallic materials frustrate radar since the beam is not reflected by plastic or glass unless it is coated by chrome or some other metal. As an antidote to exposed metal, in the late Eighties a sharp Denver guy named Kip Fuller, the same fellow who invented the electronic ankle bracelet for parolees under house arrest, invented the Stealth Bra. This was a car bra lined with a thick layer of radar-absorbing foam, the same stuff used by the military.

To test the magic bra, I first squared off against a Porsche 911 Turbo wearing one. The owner had also gone to the trouble of fitting removable headlight covers of the same material, a bit extreme in my opinion, because it rendered them useless and was also likely to attract the attention of lawmen, particularly if he forgot to remove the blinders after sundown.

Using both X- and K-band radar (the bra wasn't claimed to counteract Ka-band) I found that while target range was reduced by a few hundred feet, all the radars could easily find the Porsche's front license plate and register a target speed. When we removed the plate, range dropped by another few hundred feet but the car still wasn't invisible. We found that that its prominent outside mirrors were big enough targets for the radar.





☛)) In very light traffic there's generally little doubt about which target the radar is monitoring. This driver didn't spot the marked cruiser until his speed had been monitored for several seconds.

At 31 mph over the limit, he could be charged with criminal speed in many states, a misdemeanor rather than a civil infraction, with jail time possible.

Police radar has other limitations. It is generally impractical for use on very heavily traveled road-ways unless the target is in whichever travel lane is nearest the parked police vehicle. A trooper sitting on the shoulder of the New Jersey Turnpike in rush hour will be lucky if he's able 15 percent of the time to identify which vehicle his radar is reading. As the radar beam jumps erratically from one target to another, the target-speed display will be flashing different speeds, like the scoreboard of a hyperactive Spiderman pinball machine.

Just like in a university, senior training officers lucky enough to weasel tuition and expenses from their commanders can attend a week-long radar-instructor class offered by the prestigious Institute for Police Technology and Management, a Florida-based law enforcement academy. IPTM offers a range of advanced courses, mainly for academy instructors and command staff. Graduates of their excellent radar-instructor program are certified to be qualified to train officers in radar operation.

To pass the course, my classmates and I were required to visually estimate 50 target speeds with an accuracy tolerance of plus or minus



3 mph. Most of us were experienced radar operators. But while nearly everyone was able to meet the requirement, I noticed that instructor Kevin Morrison, an ex-Largo (Florida) PD veteran traffic officer and acknowledged radar expert, didn't require us to estimate speeds of vehicles much farther than 600 feet away. That's because any experienced officer knows that the human eye becomes more subject to error as the distance becomes greater. In poor light, on uneven terrain or when the target is heading directly toward you, the level of difficulty becomes even greater.

This is not to say that some exceptional officers can't accurately peg target speeds at longer range. For decades, California Highway Patrol officers were renowned for this ability, something I learned first hand. Crossing the Donner Pass into northern California on I-80 one time, I was stopped by a CHP Ford. No big deal; I wasn't driving much over the limit. The officer was mainly interested in the Mustang I was driving, particularly since there was an advanced new radar unit mounted on the dash.

At that time, the CHP was the only highway patrol in the nation that wasn't allowed to use radar on interstate highways. Perhaps a few hundred units were being used by the department's 2,800-odd troopers, but those had been furnished by county governments and were to be used only on within the county on state highways. (This changed in 1998 and today nearly every CHP car has dual-antenna moving radar.)

The trooper who stopped me had been sitting at the top of a free-way on-ramp. When I passed by, he'd accelerated down the ramp and eased in behind me, slowly closing the gap. By the time he'd approached to within about an eighth of a mile, I'd seen his black-and-white in my mirrors and had coasted down to exactly the speed limit. (Spotting CHP cars is made more difficult by the fact that rural patrol cars generally aren't fitted with light bars. Only the metro units have them.) But he'd already seen enough and lit me up. When he walked up to the car and glanced inside, he saw the new radar and couldn't resist asking about it. (Cops love toys, especially those they can't have.)

So we chatted awhile about radar. Eventually, I asked him what he'd estimated my speed at.

“Oh, 79, 80,” he answered. “What *were* you running?”

“About that. You know, you CHP guys are supposed



to be about the best in the business at visual estimates, what with not being able to use radar or VASCAR,” I said. “But I bet you can’t call 8 out of 10 within three miles an hour.”

“You’re on,” he said.

The trooper stood on the shoulder next to my open passenger window and started calling out target speeds. I used the radar to verify them. And he won. He nailed nearly every speed he called within two mph or so, a truly impressive performance. But I noticed that none of his targets was much over 750 feet away.

Logic would suggest that most drivers will spot a marked police vehicle when it’s only 700 feet away. No way. The typical driver is looking less than 50 feet in front of his car. (Why else do rear-end collisions account for over 40 percent of all accidents?) To paraphrase a popular aviator term, the motorist is driving a hundred yards *behind his car*. Translation: in an emergency, by the time the brain finally gets the message and he reacts, he’s already toast. Since the average driver is devoting perhaps three percent of his attention to the task of driving, there’s no anticipation of trouble, no thought given to “what-if” scenarios. Any unusual event—like seeing a police car pop over a rise ahead—will come as a complete surprise.

A driver’s ignorance of events taking place to the rear is even more profound. The average driver doesn’t check his mirrors from one month to the next and takes zero interest in what’s going on back there. Driving fully marked police cars, I’ve pulled up behind drivers moving along at 85 to 90 mph and, locked in step only two car-lengths behind them, followed for miles without being noticed. This is an example of a phenomenon called tunnel vision: the faster the speed, the narrower the driver’s field of vision. Checking the mirrors is the last thing most will be thinking about.

So in most cases, an officer incurs little risk of discovery by following procedure and approaching the target to near point-blank range, making absolutely certain of target identification.

As an example of typical distracted driving, recently my company put on a civilian radar-training demonstration for a major radar detector



manufacturer. Using our police vehicles and an array of widely sold radars and lasers, it was our task to show the client's customers, detector-buyers from major big-box retailers, how speed-measuring equipment is used by police.

On the first morning, as a sort of bonding experience and to break the ice, I arranged to make a mock traffic stop on the client as he drove to the event site with his guests. In full uniform, with badge and gunbelt strapped on, I drove slowly in the direction he would be approaching from. And right on cue, his Lincoln hove into view.

Not knowing if he was packing a detector (after all, he is a senior executive of a major detector company), I had the Decatur Genesis II moving radar on RF Hold, warmed up but not transmitting a signal. Waiting until point-blank range, I hit the front-antenna Transmit button and locked-in his speed at 68 mph, well over the 50 mph posted limit.

They passed the fully marked police Ford Expedition without ever noticing us mere feet away in the opposite lane. As I executed a snap U-turn in pursuit, the supercharged and intercooled, 370 hp 5.4-liter engine coughed once and died, the result of a software glitch in the newly reprogrammed powertrain computer. As I sat there helplessly cranking the engine, the veep blithely drove away. A minute later the engine finally caught and I lit up the steamroller 295/55-18 rear Michelin Pilot Sports as we took off in pursuit. Three miles down the road, we met him coming from the opposite direction, having driven far past the meeting point and given up on the traffic-stop scenario. I hit him again with the radar and flipped on all eight front red and blue strobe lights to get his attention. Again they sailed past with no sign of recognition.

After yet another U-turn, I finally caught and lit him up with all eight red and blue front strobe lights. I also flipped the 100-watt siren controller to the *Wail* setting and gave him a long blast. That got his attention. But later, after the laughter had subsided from our bogus traffic stop, *all the occupants* of the vehicle, driver included, admitted that despite having met us not once but *twice* on the narrow two-lane road, they hadn't noticed our massive police SUV until the moment we pulled up behind them.

Okay, so the rules say that an officer is required to obtain a proper tracking history before taking enforcement action with radar. That doesn't necessarily mean every officer follows procedure. One West Texas



deputy sheriff was legendary for his unconventional speed-enforcement practices. For example, late one night, parked on the shoulder, he was chatting with his passenger, a friend of mine who is a veteran radar salesman. They were watching as the faint glow of headlights appeared over a slight rise, perhaps a mile and a half up ahead. The two continued chatting amicably until, as the target car passed by, the deputy abruptly switched on his overhead lights, U-turned and stopped the guy. Without ever activating his radar.

After writing the hapless motorist a ticket for 76 in 65 mph zone, the officer climbed back inside. “You wrote that guy?” my friend asked in astonishment.

“Yep.”

“But he wasn’t running all that fast. Maybe ten over. Hell, you didn’t even check his speed.”

The deputy said, “Didn’t need to. Guy was from Ohio. Thousand miles from here. I figure *somewhere* between here and there, he was over the limit. So I wrote him.”

So much for procedure.

A trooper using moving radar begins his shift by checking the aim of his antenna—straight down the centerline of the car and about one or two degrees below parallel with the road—and verifying its accuracy. Accuracy is checked by means of tuning forks, internal circuitry and road checks. After warming up his unit the trooper takes a tuning fork of known frequency, strikes it on a hard surface and holds it in front of the antenna. If the radar displays the same speed that’s stamped on the fork, the unit is in good health. Most manufacturers include two forks, one for low speed, typically in the 30-40 mph range, one for high speed, usually 60-75 mph.

All modern radars go through a self-test sequence when first powered-up. Many also automatically cycle through self-test at regular intervals. Digital radar is so good that it’ll identify an internal problem automatically and either alert the officer, quit working, or both. Tuning forks are an anachronism. But judges love them, maybe because this is one piece of Stone Age technology most can understand. At any rate,



📡)) More on Directional Radar and Fastest Speed processing in Chapter 4.

every radar comes with tuning forks, and officers are expected to use them. Most do. But even if they don't, in court no one will be able to prove otherwise.

Road tests are simplest of all. The trooper simply compares the radar patrol speed to his speedometer. They generally coincide, because radar has an accuracy tolerance of one to two percent and modern digital speedometers are equally accurate. But fleet maintenance personnel in every well-managed department always check a patrol vehicle's speedometer for accuracy, once when the car first enters service, usually annually afterward. (Small-town departments rarely bother, which can give a sharp defense attorney an edge in court.)

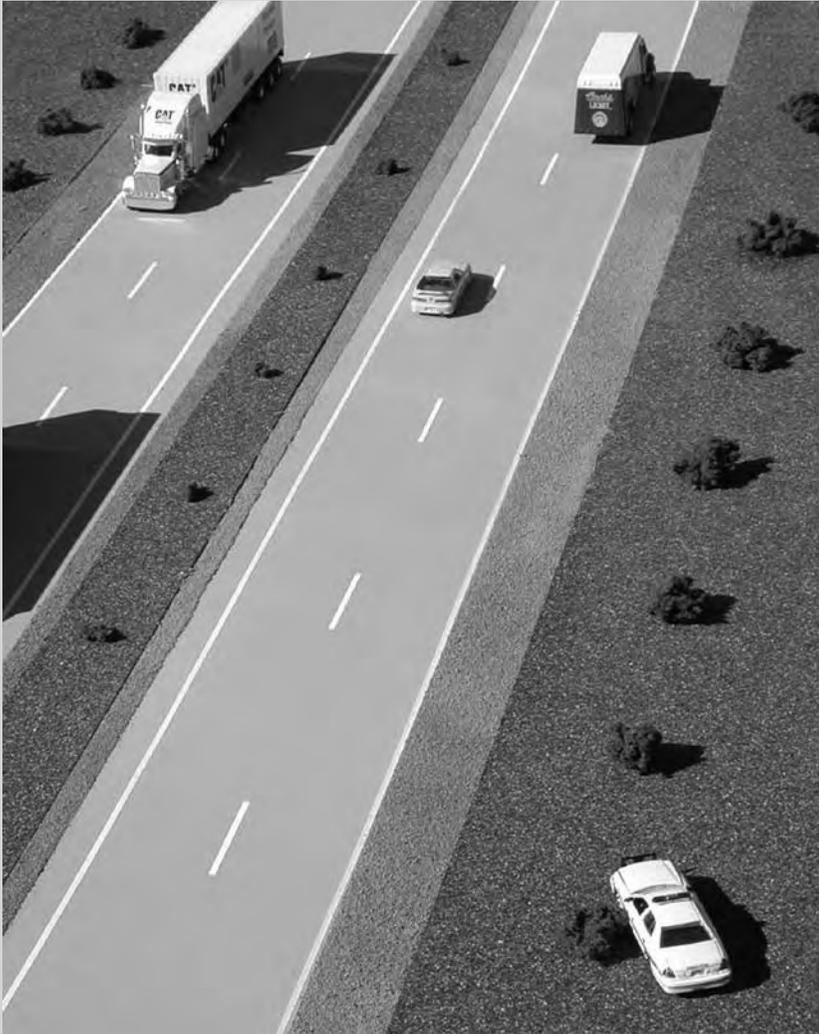
Until 2000, stationary radar—either a moving radar placed in stationary mode or more likely, a hand-held “gun” that works only from a stationary position—monitored targets going in both directions (called *bidirectional operation* in the trade) and always showed the speed of the strongest. That changed with the arrival of *Directional Radar* and *Fastest Speed* processing, making this type of radar particularly lethal to the unwary.

On the road, the targets a moving radar can monitor depends upon whether it's placed in moving or stationary mode. In moving/opposite mode, it will look at opposite-lane traffic approaching the moving patrol car from the front. That's the mode I used to pop the client in his Lincoln.

In stationary mode with the patrol car parked, the front antenna will monitor both approaching and departing traffic in front of the cruiser. Today's moving radar frequently can single out the fastest target using Fastest Speed. Many also have Same Direction processing, also known as Same Lane. Using this, the officer can target vehicles ahead of or behind the rolling cruiser. The unique Stalker II hand-held radar combines all these features. With battery/handle removed, it can be dash-mounted to function as a directional moving radar and can even be linked to a rear antenna, making it a dual-antenna moving unit.

Every radar model produced in the past decade has RF Hold, or instant-on operation, a feature designed to defeat radar detectors. It works, but there's still a way to spot radar being operated in RF Hold mode.





📡))) In stationary mode, radar can monitor approaching and departing targets. The latest models can track any of these targets.

Moving radar units today are typically ordered with two antennas. One is mounted on the dash, shooting forward through the wind-shield, the second is mounted on the package tray on the driver's side, aimed rearward.

This feature was initially offered by Decatur Electronics on their early 1980s-vintage MV 715-model moving radar. The reason: their first generation RF Hold feature didn't work so hot with a single antenna.



Troopers using those units found that when coming off RF Hold to transmit, the radar took as long as three or four seconds before it could again determine patrol speed. Until it could read patrol speed, the radar couldn't display a target speed. This meant as much as a four-second delay before the trooper could lock-in a violator's speed. Armed with a radar detector and four seconds of warning, those early Decatur units were easy to outwit.

Decatur engineers couldn't find an inexpensive way to fix the problem so they adopted the novel approach of using two antennas. The second was mounted behind the driver and aimed to the rear. This antenna's normal function was to feed continuous patrol speed data to the computer. With a separate source for this information, the computer now only had to acquire target speed from the front antenna. This allows sub-second response time with the RF Hold feature.

Unfortunately for scofflaws, a rear antenna gives moving radar unprecedented versatility. By switching to the rear antenna in moving/opposite mode, the trooper can target cars after they've passed him, hitting them from behind as they move away in the opposite lane.

This feature was first introduced in the mid-1980s. I'd heard of it but had never seen it in action. That was until I was en route to Austin one summer evening, cruising along state highway 71 in the rolling Hill Country of central Texas, just south of La Grange. (For film-trivia mavens, La Grange is the town made famous by its sporting ladies, popularized in the early-eighties movie *Best Little Whorehouse in Texas*.)

I met a trooper at the top of a hill. We saw each other at the same time and as I nailed the brakes, he triggered his radar. I'd entered panic-braking mode out of habit, but it seemed like a waste of time.

As we passed each other I watched the mirrors. He slowed then crossed the median and turned in pursuit. Foolishly, knowing he must have had a dead-bang clock on me, I'd already abandoned my braking efforts and had resumed cruising speed. When he switched on his red-and-blue lights I coasted to a stop on the shoulder.

Pausing as he wrote the ticket, he asked, "How fast you goin back there?"

It's always a temptation to suggest a lower speed in the faint hope you'll be believed. And it's never wise to admit guilt. Officers sometimes





☛))) If the officer fails to get a target speed using the front antenna, he can easily switch to the rear antenna and clock the vehicle going away. Unmarked patrol cars or marked units at night use this feature with devastating success.

ask this question because they don't *know* how fast you were going. If you're dumb enough to admit guilt, they'll be more than happy to note that on the ticket.



But in this case it seemed inconceivable that he'd failed to get a solid reading. Figuring I was dead meat, I came clean.

"Probably about eighty," I admitted.

"Close. Got you at 78". And he wrote in the number. Then he paused again.

"But I got you *going away* from me." He smiled.

"Didn't get a speed on you comin at me so I went to the back antenna. Shoulda stayed on the brakes. I wouldn't a got ya at all."

This was an expensive lesson. In subsequent encounters I began religiously following my own first rule of radar encounters: regardless of cruising speed, spike the brakes instantly, reduce speed and keep it there until the radar is passed. Even if you're under the limit, radar still makes mistakes. (Actually it's usually the operator's mistake, but the result is the same—you get a ticket. More on this later.)

As this Texas incident illustrates, sometimes radar—for absolutely no good reason—will fail to produce a target speed. Those little electrons flying around don't always perform according to Dr. Doppler's theory. But more important to know is that there's a long list of operating errors common to radar, particularly moving radar. What's this mean to you? Simple: learn about the technology you're up against and protect yourself accordingly. You don't have to be speeding to get a ticket.

DRIVER'S GUIDE TO POLICE RADAR

Everything You Need to Know About Speed Enforcement

Ever get stopped for speeding? Most of us have. In almost every case, the officer will use radar, laser or a time/distance computer to check your speed. Yet not one driver in 10,000 has the first clue about how that technology is actually used against them.

Read this book and you'll know *exactly* how police speed-measuring technology works. (At least, you'll know how it's supposed to work.) It's good, but not every ticket issued by officers using it is justified. Mistakes do happen — usually by the officer, not the hardware.

If you drive, you owe it to yourself to learn the basics about how radar, lasers and time / distance computers work.

For the first time, here's everything you need to know about:

- **Moving radar:** able to check your speed from a rolling cruiser
- **Same Direction radar:** used to check same-direction targets, ahead of or behind the rolling cruiser
- **Fastest Speed radar:** singles out the fastest car from a pack
- **Instant-on radar:** designed to defeat radar detectors (it can)
- **Hand-held radar:** the tool of choice for city police
- **Lasers:** how LIDAR works and how it's used for enforcement
- **Time/Distance Computers:** accurate — and undetectable
- **Radar and laser jammers:** fact vs. fiction
- **Aerial speed enforcement:** How the "Bear in the Air" nabs speeders



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