The VORAD Vehicle Detection And Driver Alert System

By Carol F. Maxwell & E.S. Gurdjian, F76350

Accident n. an event that takes place without one's foresight or expectation, especially one of an afflictive or unfortunate character.

Statistics show that vehicular accidents cause 3.5 million injuries each year, including 40,000 deaths. In a given two-hour period, 1,600 accidents, 800 injuries, and 10 deaths will occur on U.S. highways. Since many of us log more than the average amount of driving hours, these numbers are of special interest.

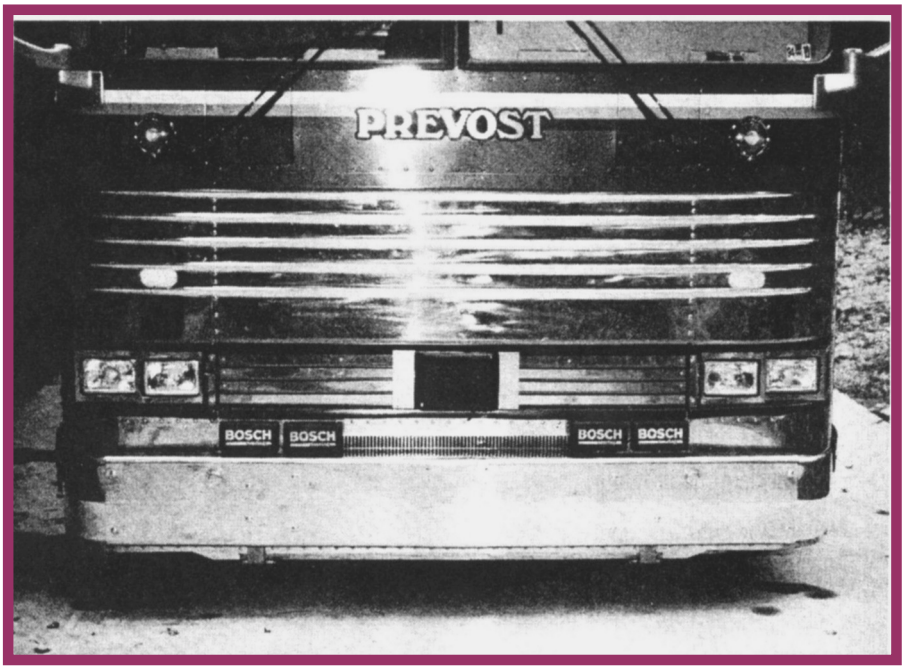
VORAD Safety Systems, Inc. took heed of a Daimler-Benz study that indicated that if drivers were given just a half second more time to react, they could avoid 60 percent of rear-end collisions, 50 percent of intersection accidents and 30 percent of head-on collisions. Using proprietary aerospace technology, this company developed a product that provides the additional reaction time.

The VORAD (Vehicle Onboard Radar) system transmits and receives microwave signals and can track up to 20 moving or stationary objects within its range. Using this data, it alerts the driver to the presence of other vehicles or obstructions in front or to the side so that through evasive action he or she can try to avoid a collision. According to VORAD, the system can penetrate darkness, dense fog, dust, or smoke to help drivers detect unseen hazards. This helps to reduce the number of traffic accidents, thereby minimizing property damage and lowering insurance claims and costs.

Component Parts:

The **antenna unit** is a 1½ inch thick black rectangle measuring 10 inches by 7 inches that is mounted in the center of the vehicle nose. The antenna sends and receives microwave signals and is aimed straight ahead with a range of approximately 350 feet. The antenna sensor can track up to 20 moving or stationary objects and it actually maintains data on the three closest objects.

The **electronic control assembly** is mounted inside the vehicle, near the driver's seat. This is the central "brain" that



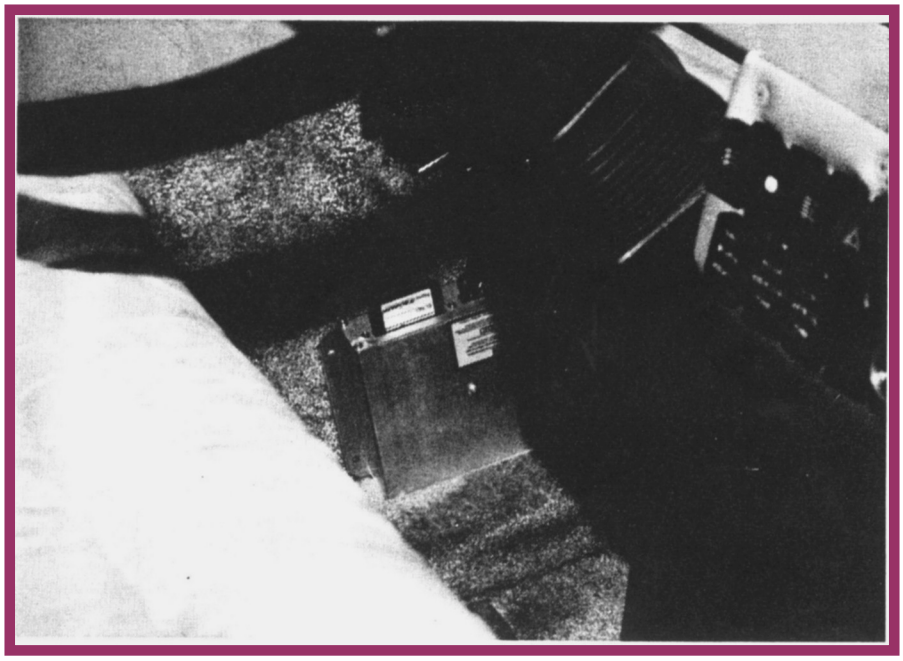
The rectangular antenna sensor mounts to the front of the vehicle and can track up to 20 moving or stationary objects within its range

By borrowing an idea used on Greyhound buses, motorhomers can enhance driving safety with a system that helps to detect other vehicles and obstacles alongside or in front of the coach

receives data from the external perimeter sensors. After analyzing the data, it sends the appropriate signals to the display units and speaker to communicate with the driver. It also runs a complete system check every 15 seconds. If it discovers any malfunction, it sends a signal to warn of the failure. Additionally a code indicating the cause of the failure is stored in its internal memory until the system can be checked.

The **control/display unit** is mounted in the dash area where it can be conveniently and comfortably seen by the driver. The display unit contains a green light, two yellow lights, two red lights, and a photo cell that adjusts the light intensity to surrounding conditions. It also has a volume knob to adjust the speaker, and a range adjustment knob. The **speaker** is a separate unit that also is mounted in close proximity to the driver.

If the VORAD equipped vehicle is within five seconds or more following distance behind a vehicle, the green light will be lit. If the driver closes to a four-second following distance, one yellow light will appear and the green light will go off. If the lead vehicle is within three seconds two yellow lights will appear. When the distance decreases to two seconds, two yellow lights and two red lights appear and are accompanied by one short audio tone. This is a good time to apply the brakes or take other evasive action! In addition, the system includes a "danger" warning and a "creep alarm. The "danger" warning is for stationary objects or slow-moving vehicles and is signaled by both the yellow and red lights, plus two short tones of the same pitch. The "creep" alarm is a yellow warning light that tells you there is an object in your path when you are "creeping"-for instance, anticipating a traffic light changing from red to green.



The electronic control assembly mounted near the driver's seat, is the central "brain" that receives data from the external perimeter sensors.

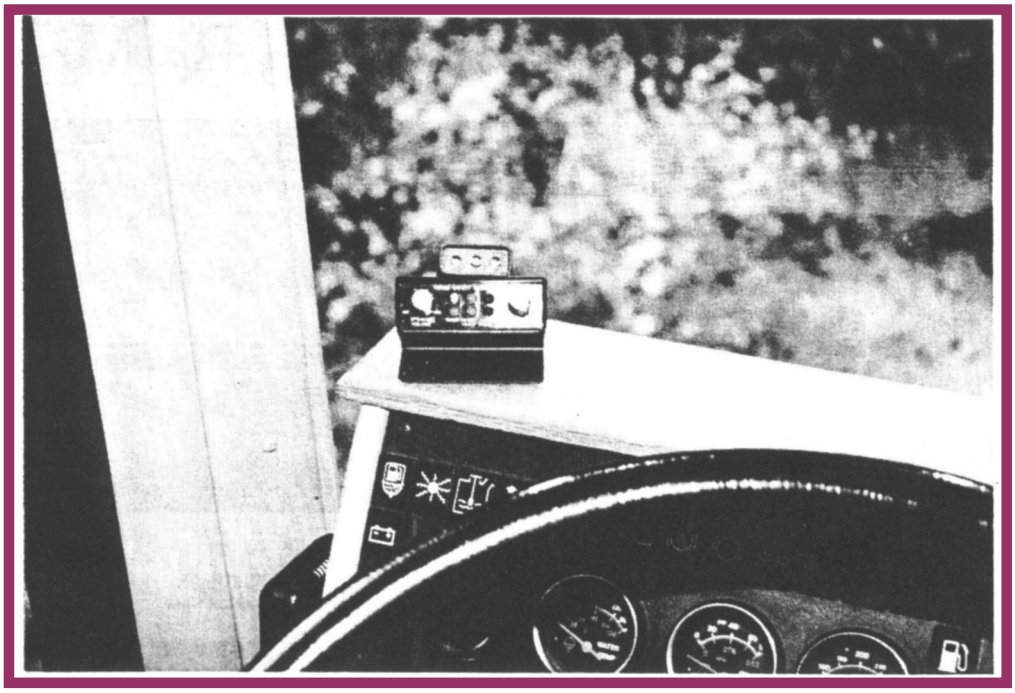
The **side sensors** are mounted on one or both sides of the vehicle. They have a range of one lane and should be located to detect another vehicle in the "blind spot". The side sensors send signals to the **side sensor display unit(s**), which the manufacturer recommends be mounted near the rearview mirror in the driver's line of sight to allow an easy check of the sensor display with every mirror check. A yellow light indicates that no vehicles are detected and a red light indicates that a vehicle is within sensor range. An audible sound accompanies the red light only when the directional signal has been activated; that tells the system that a collision is about to happen, and so it gives a warning tone.

The electronic control assembly is fitted with a **memory card**. This card is equipped with an accident reconstruction recorder (essentially a black box such as those installed in airplanes) to record data that reflects events leading to an accident. The card is also an electronic I.D. and could be set up as a theft deterrent. That is, the card must be inserted to unlock the ignition. So even if someone has the ignition key, the engine would not start without the card.

Installation:

We arrived at the VORAD facility on a Thursday morning, as scheduled. After a brief tour and a meeting with key personnel, we prepared to install the VORAD system on our Prevost. Because this installation would not be permanent we first had to determine how the components could be attached without drilling holes or damaging the coach. Whenever we test a product, we like to do our own installation, not only to protect the coach but also so that we can better understand the product. This usually is more time-consuming and entails a great deal of questions. The VORAD engineers were extremely helpful, understanding, and patient.

Installation of the front antenna actually was quite easy. First, a stainless steel adapter plate was attached to the antenna housing. The stainless steel skin on the front of the coach just above the bumper, is held in place with rivets. Four rivets were drilled out, and the antenna adapter plate was secured to the bus using stainless steel screws. No extra holes needed to be drilled, and the rivets can be replaced when the antenna unit eventually is removed. Wiring from the antenna unit was then routed through the front compartment up to the dash area.



The control/display unit is mounted in the dash area where it is within view of the driver and contains warning lights to signal the driver.

The electronic control assembly, which is about the size of a cigar box, was mounted in the driver's area along the left wall. The control/display unit sits on top of the dashboard, in front of the steering wheel and the speaker was mounted near the dashboard using double-sided tape.

For our test purposes, two right side sensors were used-one with horizontal polarity and the other with vertical. In addition, a horizontal side sensor was mounted on the left. All of the side sensors were mounted using pressure-sensitive tape to eliminate drilling holes. The wiring for the side sensors runs from the electronic control assembly down to the front compartment, to which one gains access by dropping the front bumper and through a tunnel to the second bay on both sides. Since we have needed extra wiring for a number of projects, we have lengths of speaker wire secured in tunnels and conduits through which we can easily pull new wires. This feature greatly enhances our ability to add new equipment on a temporary or permanent basis. The side sensor display units were mounted near the right and left windshield pillars, respectively, so that they can be seen while looking at the mirrors, Wiring from these sensors passes through the dash to the electronic control assembly.

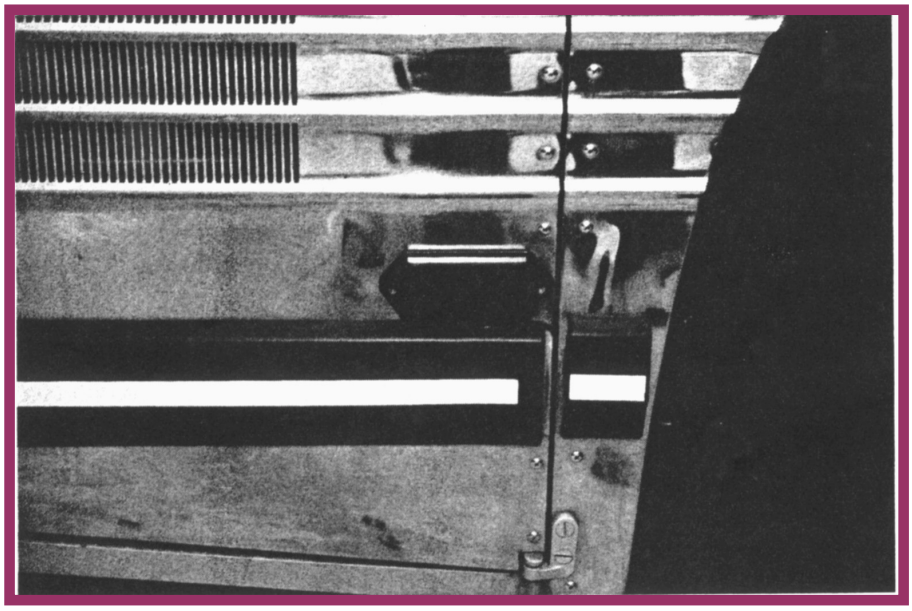
The last two items to be installed were a magnetic sensor assembly attached to the lower steering column, and a speedometer interface. The steering sensor was easily fitted to the Prevost column, which is very conveniently located behind an access door. However, because most of the VORAD systems that are in use have been installed in Greyhound buses, the speedometer interface was not compatible with our speedometer and had to be specially adapted. Other than the speedometer, we had all components installed by Friday afternoon. The speedometer interface was completed on Saturday. The speedometer and directional signal were wired to the electronic control assembly from the front wiring panel of the coach, and the steering sensor was wired directly.

Upon completion of the installation, we went for a test ride. The VORAD engineers aimed the antenna unit, and with their computers, initialized, programmed, and calibrated the system. By noon on Monday, we were eastbound.

On the road with VORAD:

From San Diego, we were headed for the Converted Coach Chapter rally, "April in the Carolinas." We were due in Salisbury, North Carolina, on Thursday, so we drove during daylight and evening hours in order to arrive on time. This gave us a chance to become used to the various warning lights and audio tones. We timed the following distances using a stopwatch to verify that the signals were quite reliable.

By listening to the CB radio, we learned that the truckers were dismayed by the interference to their radar detectors. We



The side sensors detect the presence of obstacles such as other vehicles in the "blind spot" and have a range of one lane.

found this to be annoying, because immediately after passing us, truck drivers would apply their brakes in response to their radar detector alarms. Some were aware that there was some new gadget out there-some even knew that it was on a number of Greyhound buses-but they were not sure of its purpose. We found the drivers in the West to be more distressed than those in the East. Since our installation, VORAD has received FCC approval to produce a new antenna that has a frequency other than that used by police radar.

After the first hundred miles or so, we recognized that the vertical side sensor was not useful and replaced it with one having a horizontal polarity. The side sensors will detect the presence of guardrails and overpass bridges, as well as other vehicles. One must remember that the sensors tell the driver that something is there but do not interpret what that something is.

The trip home to Pennsylvania was uneventful, and the VORAD system performed as expected. Perhaps because we were paying more attention to what was going on in close proximity of the coach, we noted that we do not have big blind spots along the side of the coach. Our coach is equipped with Ramco mirrors and, when they are properly adjusted, the entire length along each side of the coach is completely visible. We did, however, become more aware of the difficulty involved in entering traffic at a 45 degree angle. Vision in this direction is impeded by the pillar behind the driver's seat, and many of us have arthritic changes in the neck that decrease our range of motion.

Jerry Woll at VORAD thought it would be impractical to use sensors for the direction and distance needed for the 45 degree angle, so we contacted Bill Reed at Ramco Engineering. Bill sent a set of convex mirrors that are attached to the top of the regular side mirrors. Voila! We now can see at a 45 degree angle.

Initially, VORAD developed the side sensors to aid in turning, Since large vehicles need to make wide right turns, this would alert the driver if a smaller vehicle had slipped into his or her turn path. Historically, trucks have few accidents during left turns, so the side sensors are not used on the left. Nonetheless, we wanted to monitor the full length of the coach on both sides to determine whether we found any value in this additional information. Mark Harmon, VORAD's field service and support manager, was going to be traveling to the East, so he added a trip to Blacksburg, Virginia, to his agenda. Since FMCA was hosting its convention there, this was the perfect opportunity for him to bring us the additional equipment while becoming acquainted with FMCA.

Shortly before leaving for the convention in Blacksburg, we experienced a heavy rainstorm in our area. The driver side window had a leak and water ran into the VORAD electronic control assembly. We dried it off, and it seemed to be functioning satisfactorily when we turned on the ignition switch. A we started on our way, the system became somewhat erratic; so, we called Mr. Harmon, who said he would bring another assembly with him. We continued on our way and, to our surprise, the assembly repaired itself. We did notice however, that the side sensors interpreted the sheeting action of rain as an obstruction.

Even though the electronic control assemble was performing properly when Mr. Harmon arrived in Blacksburg, he opted to replace it. He also brought two additional side sensors and an interface to join two side sensors on each side. We wanted the additional sensor, because

we felt that one sensor was inadequate to "see' the entire length of the coach. The new interface provided a "delayed off" function, so that the LED (light emitting diode) of the side sensor display would have a continuous "on" as a passing vehicle moved from the rear sensor to the front sensor.

We made several adjustments in the side sensor positions over the next few thousand miles to find the best mounting location. Because we were using double-sided tape, we were able to move them up and down and fore and aft. We finally decided that the front sensors performed best on the top front edge of the second bay door. This is located approximately one-third of the way back along the length of the coach and 35 inches from the bottom edge. The rear sensor ended up at the very back of the coach, approximately 45 inches from the bottom edge. From these sensor positions, the red LED on the side sensor display remains lit from the time that a passing vehicle reaches the left rear of the coach until it is well past the front end. This same feature allows us to pass a vehicle to our right and know when the coach and towed car are safely past. Of course, the VORAD is not intended to allow drivers to pass without a visual check, but it does provide an additional parameter. We also changed the location of the side sensor display units. They were mounted in line with the rear-view mirrors. We attached them to the right and left sides, respectively, of the control/display unit. In this position, the driver can tell whether another vehicle is on either side without taking his or her eyes off the road. As mentioned earlier, the side sensors will detect approaching traffic on a two lane road as well as guardrails, bridge abutments, and other obstructions. We do not consider these to be "false alarms," because they do need to be avoided, but the driver must interpret the LED signal. In the nearly 20,000 miles of driving we have done with the VORAD system on board, the side sensors have never made an error or omission.

Other than the replacement of the electronic control assembly in Blacksburg, the VORAD system has not needed any adjustments since the installation and initialization procedure. We found that it is not prone to false alarms, and it has reliably notified us of changes in the following distances to other vehicles. On one occasion when the driver's attention was averted from the road, the system warned us that the truck in front of us had slowed suddenly. This was evidence that the system is a useful adjunct when the driver is tired or distracted. We did not, however, encounter any situations or crises that allowed the full testing of VORAD system under adverse conditions, but it is clear that should one find oneself in poor visibility situations, the VORAD would be an invaluable tool.

The basic system includes the front antenna, right side sensor, electronic control assembly control/display unit, speaker, and side sensor display unit. At the time of publication the price for the basic system was $2,390.00 With data recording ability, accident reconstruction, starter interlock, and additional side sensors, the price could reach $3,000.00

For further information, contact VORAD Safety systems, Inc,. 10802 Willow court, San Diego, CA 92127; (800)782-7825.