Advanced Low-EMF Cars

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Advanced Low-EMF Cars

This is the second article in the series about low-EMF cars and other vehicles. The reader is expected to have read "Introduction to Low-EMF Cars," as it contains information to try first, before attempting the modifications discussed here. Most people with Electromagnetic Hypersensitivity (EHS) would not need measures beyond that first article.

This article assumes some level of technical understanding. Less technically inclined readers may still benefit from some parts, while skipping over some sections.

Much of this information focuses on diesel cars and trucks, as it often would not make sense to modify a gasoline powered vehicle (a gasoline engine requires the use of an alternator and ignition coil, which are two main sources of EMF.)

Both general information as well as specific "how-to" instructions are provided. It is not necessary to understand the background information in order to follow the instructions. Specific information is given for modifying Mercedes 300D and 300SD cars from the early 1980's, though the principles should apply for other models and makes.

The reader is urged to seek competent help before embarking on significant modifications. The author assumes no responsibility of any kind for the use of this information. Some modifications may be illegal; some may impose an increased risk to the safe operation of the car. There is no guarantee that a modified vehicle will work as intended. This article reports on personal experiences, which may not be applicable to others.

This article is not medical advice. Anyone using this information assumes the full responsibility for their actions and results.

The Upgraded Gaussmeter

People who are sensitive enough to need the information in this article, will need an upgraded gaussmeter. The commonly sold models are simply not as sensitive as the person. The most cost effective instrument is the TriField gaussmeter, outfitted with the optional external probe. This 100x probe makes the instrument a hundred times more sensitive, capable of measuring down to around 0.002 milligauss (2 microgauss).

There is also a small 1x probe available, which has the same sensitivity as the unmodified meter, but can be very handy for pinpointing sources in tight spaces.

Please note that the probes only measure EMF in one direction at a time. To get a correct reading, three measurements must be taken at each location, with the highest reading being the correct number.

To do the three measurements, first place the probe horizontally and read off the number, once the scale has settled. Then turn it ninety degrees in either direction, and do another reading. Finally, stand the probe vertically and do the third reading.

The highest of the three readings is the correct reading for that location. With a meter that sensitive, any movement of the probe will disturb the reading.

Sources of Electromagnetic Emissions

The electrical system in a car runs on 12 volt DC, but it is not “clean” DC. DC electricity from a flashlight battery is “clean” because it is steady, unchanging. When “clean” current runs through a wire, it generates a stable, steady field, while a changing current generates a changing field. Household wiring generates a changing field, simply because it is AC electricity, which changes sixty times a second (fifty in some countries.) A wire carrying “dirty” DC electricity does similarly, just a different pattern.

A number of components in a car causes the electrical flow to be uneven, “dirty”, and thus create EMF.

The largest source is the alternator, which is an electron magnet that spins around and generates AC electricity at typically 600 to 800 cycles per second (hertz). This spinning magnet is likely to be the strongest source of EMF in a vehicle. The AC electricity from the alternator is then turned into DC electricity by rectifying diodes, which by themselves generate high frequency EMF. The DC electricity that is produced still fluctuates as the alternator turns, and that causes still more EMF from the wiring.

The ignition coil is another large source of EMF. It is responsible for gathering a lot of energy and then releasing it in one short burst, sending it to the spark plug that is firing. These rapid changes also cause EMF emissions on the electrical circuits. A diesel engine has no spark plugs, and thus no coil.

The fuel pump is typically located in the fuel tank, which is usually hanging under the trunk of the car. It is thus well away from the front seats and somewhat removed from the rear seats, though the wire feeding it electricity can radiate EMF as it passes through the car. A few vehicles have fuel pumps driven by the engine, which is much preferable.

The Wiring Acts As Antennas

The body of the car, and the wiring inside it, distribute the electrical emissions generated by the electronics. If the electrical system only carried “clean” DC, this would not be a problem, but with the fluctuations produced primarily by the alternator and the ignition coil, it can be.

There are two parts to this problem: first, when a fluctuating current runs along a wire, EMF is radiated from it. The most radiant wires in a car are likely to be the ones linking the alternator, the ignition coil and the battery. Unfortunately, the ignition coil is usually linked to the ignition key, close to the driver.

The second issue requires a longer explanation. In a home, the wiring in the walls have two leads: the phase and the neutral (there is often also a grounding wire.) The electrons travel out on one wire and return on the other. This back-and-forth on different leads close together has the nice benefit that it lowers the EMF radiated form the wire, compared to if the two leads were run at a distance to each other.

In a car, there is only one lead, the positive wire. The negative “wire” is the steel body of the car, the chassis. There are many paths for the electrons to go back to the battery through the chassis. Which one is chosen will vary with the model of the car, and perhaps even between cars of the same model, due to minute differences in the manufacturing.

The current thus runs in a loop, which is really a coil with just one turn. And coils generate EMF, when fed a variable current, such as our “dirty” DC. This may not be a real problem, or it may. Compared to the EMF from the alternator and the ignition coil themselves, this should be much less in almost all cases. A reported example where it is a prominent problem, is in a vintage Volkswagen van, even though the alternator and the ignition coil are located in the rear of the vehicle.

In any vehicle, attempts to shield wires would perhaps only work on half of the problem, as it is not possible to shield the whole chassis. The wires would be a more concentrated source of EMF, while the chassis would be more diffuse, except in hot spots, such as where the battery is connected to the chassis. A way to get around this problem would be to string wires to carry the negative current in the vehicle, in particular between the battery, alternator and ignition coil and perhaps the fuel pump, and make sure these devices are no longer grounded to the chassis. I am not aware of anyone who has tried this. It is probably much easier to eliminate the sources of the electronic noise instead.

Magnetic Sensors

Most vehicles use magnetic sensors to detect movements, such as the speed of the car, and the speed of the engine (tachometer). Anti-lock brakes are controlled by sensors by each wheel, that ensure that the wheel does not stop turning until the car is stopped.

These sensors work by generating pulses from a piece of metal passing closely past a stationary magnet. They do this completely without using electricity from the electrical system.

The sensors, and the cables that carry the pulses, can create noticeable EMF in the interior of the car. They are harder to measure, as most only appear when the car is moving. A gaussmeter can be used to identify them, but it is important to note that just the movement of the car in the Earth's magnetic field is enough to affect the meter, so one has to measure relative differences inside the car.

Older cars use cable-driven speedometers, sometimes combined with a pulsed tachometer. Newer cars all seem to use the pulse-driven speedometers.

It may be possible to remove the magnets, though it may be illegal to tamper with the odometer, as that can affect the resale value of the car. In some states, older cars are exempt from registering the odometer setting when they are registered.

It is quite possible to drive a car safely without a working speedometer, simply by using common sense and watching the speed of the other vehicles. This approach may not work for people who insist on driving right at the speed limit.

Tampering with an anti-lock brake system is not a good idea; it may cause the brakes to malfunction.

Automatic Versus Manual Gearshift

There doesn't seem to be a simple choice between automatic and manual gearshifts, regarding EMF. What is lowest will depend on the specific model, but this appears to only be a concern to the exceptionally sensitive people - those of us who drive without alternators and who degauss our tires.

A modern manual gearbox appears to still operate without electricity (other than perhaps sensors), while a modern automatic gearbox will have a few electrically operated valves (solenoids) to direct the transmission fluid. In older vehicles, like the 1980's Mercedes cars, the automatic transmission worked completely mechanically, except for the rarely-used step-down switch.

If the DC power is "dirty", as it will be in any vehicle with an alternator, the wires going into the transmission, and the solenoids, will of course act like antennas, just like the wiring in the rest of the car.

An automatic gearbox uses planetary gears, while a manual gearbox may or may not. A planetary system may produce more EMF, from magnetized parts, than a conventional gear does, but that will still be dependent on the car.

A torque converter may also produce EMF from magnetized parts, and it is extremely difficult to degauss (I tried and failed.)

Other EMF Sources

The various electronic parts in the car all generate some amount of EMF, which will be radiated from the device itself, as well as the wiring connected to it. Newer cars have many electronic components, most of which cannot be disconnected.

It is also possible that a malfunctioning relay or electric valve will get worn and start to “flutter”, and thus generate excessive EMF.

Recreational Vehicles/Caravans

It is important to note that RV’s usually have additional sources of high EMF, such as battery chargers, inverters, converters, and possibly refrigerators. RV’s typically have two 12 volt systems, one for the vehicle itself, and another for the living space. There is often an electronic box that connects the two systems, so both batteries are charged by the alternator. It may be called a “battery isolator.” The voltage of the two systems will always be a little different. This control box takes care of that, but generates a lot of electronic noise doing it. On a RoadTrek 190 I looked at, this box was located near the driver and generated 120 milliGauss in the driver’s footwell. When disconnected, that level dropped to 20 milliGauss, while the ambient level throughout the vehicle dropped by 1 milliGauss. It may be possible to live without this device and only charge the deep cycle battery using shore power or solar.

The battery charger that charges the deep cycle battery from shore power also generates high levels of EMF and is best not used while inside. A switch to turn it off could possibly be installed, so shore power can be used without the charger being on. Solar power could also be considered for charging, just make sure the charge controller is NOT Pulse-Width-Modulated, as most are.

The inverter generates 110 volt AC from the 12 volt DC battery, but it also emits a lot of high frequency EMF. It is best to simply not use the inverter, and only use 12 volt DC, at least while not connected to shore power.

Diesel Vehicles

The oil shocks in the 1970’s caused most major car manufacturers to rush diesel versions of their cars and trucks to market. There were even diesel versions available of luxury cars, like Cadillac.

The problem was that most of the diesel engines were converted gasoline engine designs. The engines wore out too fast; some of the engine blocks even cracked. This also troubled most of the light trucks from that era, especially the American brands.

It is thus imperative to check up on the reliability history before buying one of these older vehicles. Another issue is the availability of parts - if they are hard to get, it may be necessary to keep a couple of cars for spare parts.

Mechanics familiar with a particular car model can be a treasure trove of information. So can car parts stores specializing in that make. And there are often web sites maintained by enthusiasts.

When looking at a vehicle it is important to decide whether to remove the alternator or not. Without the alternator, the car must really be miserly with its electricity consumption. There cannot be high-usage devices, such as:

- Electric fuel pump
- Electronic fuel injectors
- Constant cooling fan
- Electric cooling pump

There simply does not seem to be a good car-alternative to Mercedes in the United States. The Volkswagen Diesel Rabbit is simple, available and with an abundant parts supply. But the engine is side-mounted. The radiator is mounted in the front with a permanently running electric fan that creates about 80 milligauss at the driver's seat. Installing a fan powered directly by the engine is a major undertaking. There are also some reliability issues with the engine.

Volkswagen produced a diesel version of their Vanagon from 1983. It had the same engine as the Rabbit, but placed in the back. That engine was too small for this larger vehicle and the water cooled versions had a radiator up front, which probably also had a fan on it. The battery is placed under the passenger seat, with an extra battery under the driver's seat on the camper version. A low-EMF conversion may entail rerouting the electric wires away from the ignition key, moving the batteries and possibly dealing with a fan. The author has not actually inspected a Vanagon.

Volvo made diesel cars, but their engines were not good in those years. Even a Volvo dealer told me to stay away from them.

French automaker Peugeot apparently produced many successful diesel cars, but they are not available in the United States.

I have not really looked into trucks, but have been told that the best choice from the 1980's is the Isuzu light pickup. The other truck manufacturers are said to have gotten their act together with a decent engine design from about 1990, and first some years later did they put in electronic fuel injection, so there should be some model years there to look closer at, from Ford, Dodge and others.

There were a few diesel RV's available in the 1980's. Volkswagen produced a diesel Vanagon Camper until 1985. See the earlier comments on the Vanagon. Winnebago sold three small diesel RV's from 1983 to 1986: LeSharo, Centauri and Phasar. Later models were gasoline powered only. These Winnebagos were built on a chassis made by French Peugeot, which apparently produced decent diesel engines. The author has not actually inspected any of these models.

Shielding

Shielding is like air cleaners - it's a help, but it cannot make a bad situation good, just a good one better. Shielding is not a magic cure; it can produce a reduction of from 30 to 70 percent, if done well. In exceptional cases, a 90 percent reduction is possible. Very highly sensitive people may need reduction of more than 99.9% from all sources.

EMF is complicated to shield, especially at the low frequencies present in a car. Expect to experiment.

Shielding is most effective if placed close to the source, rather than further away from it. The exception is when a source is so strong it overwhelms (saturates) the shielding material.

If the shielding is further away from the source, more shielding material is needed to cover the area and there is a higher possibility of holes and slits through which the EMF can get through.

To get an idea what shielding can do, try to measure the radiation from a household breaker box, with both the steel lid opened and closed.

To shield a cable, or other point source, it is best to completely wrap it with shielding material.

If an area cannot be wrapped, try to cover the source on three sides. The middle of that shield will be the most shielded area.

It is important that the shield is much wider than the source. Otherwise, the EMF will simply loop around the edges.

Multiple layers of shielding material work, but a double layer is not twice as effective as one layer. No matter how many layers are added, it'll never reach 100 percent.

Sometimes shielding must be made from multiple pieces, to fit the location. This is fine, as long as the pieces overlap with no holes or slits. An overlap of an inch is good, and aluminum tape can be used to keep the pieces tightly together.

Typical places to consider shielding are the cables that may run along the side of the car, and in the foot well. It may work to cover parts of the footwell with shielding and wrap it around the center console. Be careful not to interfere with the use of the pedals, especially if any shielding comes loose. That could be very dangerous.

The closer the shielding is to the source, the better. It is probably of no use to try to shield anything if the shield is more than 12 inches (30cm) from the source, as a rule of thumb. The exception may be if the person is instead wrapped with a shield, like if the entire footwell is covered with shielding material. This can sometimes be done nicely by taking out the padding on the sides of the footwell, put shielding foil there, and then putting the padding back on again. That way the shielding is held firmly in place, and is also not visible. Expect to have to experiment a lot, using a gaussmeter to check with.

Aluminum foil, and meshes of copper and silver are usually not of any help in a car, as they are most effective at higher frequencies. Only if computerized components are being shielded should these materials be considered.

The strongest EMF radiation in a car happens a low frequencies, which are best handled with steel and mumetal. Ordinary plate steel works well, and is cheap. The very best steel alloy is 5% silicone steel, grain oriented. Mumetal is a special alloy developed for this purpose; it comes in thin foils that are easy to work with, but it is pricey.

At high levels of EMF, the shielding can become saturated and ineffective. It can then be better to move the shielding material back a few inches, or use another type of material better suited. Perhaps then use a sandwich, with a special high-radiation alloy on the inside and a more regular type material on the outside. Experiment.

Modifying Gasoline Powered Cars

It is possible to improve a gasoline-powered car in various ways, though they can never come near an old diesel vehicle in EMF reduction. Many electrically sensitive people do drive gasoline cars, and there can be good reasons to choose one over a diesel car, if the need for EMF reduction is modest.

First do all the modification mentioned in the introductory article, such as disconnect all unneeded circuits, etc. It does not make any sense at all to proceed with the following before that has all been tried.

Some high-frequency EMF reduction may be possible by inserting electronic EMI filters on the alternator, ignition coil and other components. Just don't expect miracles. Such work should only be attempted by a competent person, like perhaps an open-minded auto mechanic who specializes in automotive electrical systems.

Some help can be found in the book "Interference Handbook" by William Orr and William Nelson, which dedicates a full chapter to vehicle noise suppression. This author has not actually experimented with the shown methods, and is skeptical that enough can be accomplished in a gasoline vehicle for it to be worthwhile. If you do succeed, I'd love to hear about it.

Other than that, perhaps try some shielding of offending components and perhaps consider degaussing the steel-belted tires.

A Non-electric Spark Plug

A company was developing a non-electric spark plug, called the SmartPlug. Installing it would allow disconnection of the ignition coil, and possibly the alternator, like on a diesel car. The company has currently abandoned the product; it was never developed into a sellable product. Each SmartPlug had to be custom fitted to the engine, but it did work. For further information see SmartPlugs.com or call 208-265-2723. (Serious calls only, please.)

Modifying Diesel Cars

The focus in the following is modification of pre-1986 Mercedes diesel cars, but this can also be used as a guide for other makes and models. The Mercedes cars from the early 1980's are a good choice for several reasons, including:

- They were built very well
- They have mechanical fuel injectors and fuel pump
- There are no anti-lock brakes
- The transmission is completely non-electrical

- The cars and their parts are widely available

The simple modifications mentioned in the introductory article should be done before proceeding, such as disconnecting all unneeded circuits. These following modifications require some level of technical expertise. An open-minded mechanic may be a good choice.

The Alternator

This device sits at the front-right side of the engine on the Mercedes cars, and generates a lot of EMF as it spins around.

There are unoriginal replacement versions available from auto parts stores, such as AutoZone, which are designed differently, and just happen to emit less EMF.

The more effective method is to disconnect the alternator, so it no longer charges the battery, or only does so intermittently. The alternator cannot simply be physically removed, as it is needed to tighten the fan belt on the engine.

A switch could be installed to turn the alternator on from the dash board. This requires modifying the alternator to use an external regulator, rather than the one built into it. If the internal one is used, the alternator will simply start generating power at higher rpm's on its own (it starts "self-exciting" at around 3500 rpm's.)

It is important not to engage the alternator with such a switch while the engine is running, as the resulting surge will eventually ruin the alternator.

If disconnecting the alternator completely, it is important to remove both wires going to the alternator. The thin wire provides the current to the regulator, while the thicker wire sends current to the battery. With the thicker wire connected, the self-excitation mentioned above will simply happen at higher engine speeds, and nothing had been gained.

It is possible to run off the battery in these cars, as they need very little electricity to run. The driver must be aware of this, and refrain from using power-hungry features such as headlights, the defroster and the air conditioner, or at least do so very sparingly.

It can also be helpful to turn off unneeded circuits, such as the central locking system, and remove some of the light bulbs, like those under the doors.

The rear brake lights consume a lot of electricity, so it is best to turn the transmission to "neutral" or "park" when sitting for longer periods.

Some equipment may be worn out in these older vehicles, and may consume more electricity than intended. Such problems can be located by removing each fuse in the fuse box and letting the power run through an ammeter (use a multimeter on the 10 amp setting.) One problem that continuously consumed 8 amps was found that way in the author's car.

The battery can be charged with a battery charger while at home, or a solar panel can be installed to charge the battery through the day for more flexibility. Solar panels generate smooth "clean" DC electricity, which is tolerated by most. It may be necessary to use a battery charger in the winter months, even with a solar panel.

Warning - Modern cars with sensitive electronics may get damaged if the alternator is disconnected. Without the alternator, the voltage of the system will vary (usually between 12 and 14 volts), which may damage computer circuitry. In some cars, these circuits may be protected. Contact the manufacturer before proceeding. In older vehicles, like the Mercedes 240 and 300 series from before 1986, there are no such circuits to worry about.

The 300SD consumes a little more electricity that the other 300-models, as it has more relays and features.

Solar Charging

A solar system is not complicated to install. It consists of a photo-voltaic solar panel, a charge controller, and some wiring and fittings. When the sun hits the solar panel, it generates electricity. The more sun, the more electricity. The power from the panel is sent through the charge controller directly to the battery. The charge controller monitors the battery, and turns off the solar panel when the battery is full, so it does not become overcharged. Make sure the charger does NOT use Pulse Width Modulation, PWM, which charges the battery using pulses. It is sometimes called three-stage charging. Most solar chargers use this method.

The solar panel can be installed on the roof of the car, the lid of the trunk or simply placed in the rear window. All three locations may be needed in less sunny climates.

In sunny Arizona, two cars each have 42 watt panels mounted on the roof. One of them also has a removable 21 watt panel in the rear window.

The panels used in these cars are all from UniSolar, which makes panels that are able to withstand flying stones and vandalism. They can also handle partial shading, which is particularly important if placed in the rear window. The

UniSolar panels are less efficient and more expensive than the standard crystalline panels. I am aware of one modified car which uses the crystalline type.

In more cloudy climates, higher wattages will be needed. Using solar may not be workable at all in the northern winters.

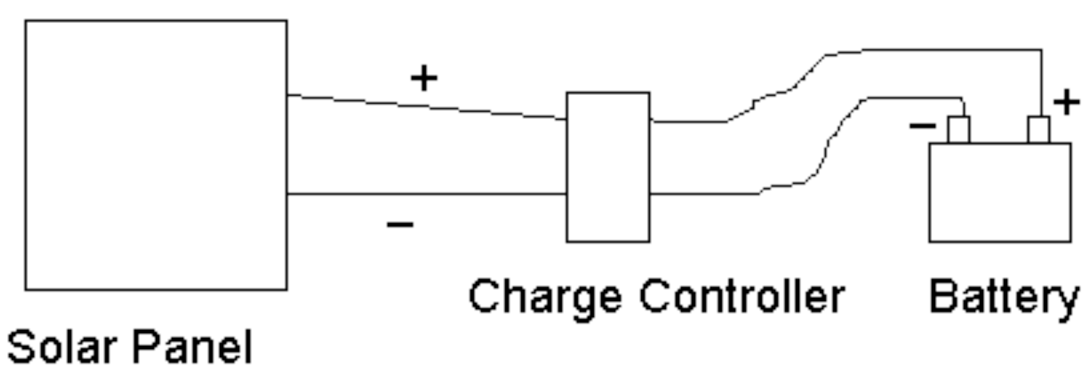
One car had the roof panel mounted on top of a Yakima sports rack. It was put as far back as possible to avoid wind noise. The 48-inch Yakima cross bar fits perfectly on a 300SD.

The other car-owner disassembled the UniSolar panel from its frame and mounted it directly onto the roof. These panels are flexible without their frame, so it could be flush-mounted.

The electrical cable from the roof rack can be brought down through a roof penetration, which can be done by a body shop. A simpler approach is to bring it through one of the rear doors, and then just not open that door any more.

The solar panel generates completely clean, smooth DC electricity, which should not be troublesome. However, most charge controllers charge the battery by sending the current in pulses, so-called Pulse-Width-Modulation, PWM, which gives a more efficient charging of the battery, but also produces EMF. One suitable charge controller is the Specialty Concepts ASC 12/4, which does not use PWM.

A basic schematic is shown below:



To gain experience, before installing on the car, try to first set up the components as shown in the diagram. Hook up a 12 volt lamp to consume electricity, and use a voltmeter to monitor the battery. Watch how fast the battery is recharged in direct sunlight, and how slow on a cloudy day, and how slow when the sun does not beat directly down on the panel. Also watch how the battery voltage drops as soon as the light is turned on, and how it recovers when it is turned off, even if the solar panel is not producing any electricity.

Electrical Consumption

Knowing how much electricity a car consumes is very important if trying to run it without the alternator. The following measurements were done on the author's own Mercedes 300SD from 1982. The other diesel Mercedes models form the early 1980's consume a little less, as they have fewer features and did not use as many relays.

A modern car or truck will consume a lot more, just for basic operations, as they have much more electronics onboard. A gasoline powered car will consume much, much more, to fire the spark plugs.

The "basic operation" line is what my car consumes with the engine running and nothing else on. This is the most important number, as that is what it needs whenever it is on. Everything else is of short duration, unless driving at night.

The heating valve is first engaged when the engine is hot. It uses electricity to block the hot water from heating the passenger compartment. It can be disconnected and replaced by a ball valve to save electricity, as mentioned elsewhere.

Basic operation	15 W
Heating valve	6 W
Glow plugs	780 W
Starter	1800 W
Brake lights	120 W
Turn signal	36 W
Electric windows	75 W
Head lights	100 W
Tail lights	80 W
Wipers	60 W
Rear window defogger	140 W

Battery Systems

It takes a lot more electricity to start a diesel engine than a gasoline powered one, both for the glow plugs and when cranking it, so the batteries in these vehicles tend to be larger. They are sized to be constantly topped off by the alternator while the engine is running, so if the alternator is removed, the battery will have to work harder and may not live as long. This is particularly the case if the battery is only charged at home, the headlights are used or the climate is cloudy. Expect the battery to only live a year under these conditions, possibly much less while the driver gets used to the new setup.

With an adequate solar system, the battery should be well charged most of the time during the day, and thus much more durable. In fact, a weak battery has been restored by constantly being charged by a solar system, all day long.

Where the battery has to work harder, it could be beneficial to upgrade to the newer AGM (Advanced Glass Mat) type batteries, such as the Optima brand.

One alternator-less car uses a split battery system - one battery for starting the car, another for running it. This way, there will always be electricity left to start the car, even if the run-time battery had been depleted. This car has been used for long interstate travel.

Another option is to put a second battery in the trunk and wire it together with the one in the front. This requires very thick cables to do properly, otherwise the front battery will do all the heavy lifting as the high currents at startup simply cannot make it through a thin cable from the back. Specialty shops that install oversized audio systems in vehicles have the right equipment for doing this correctly.

In northern climes, battery capacity becomes more important, as there is much less sun to charge the battery, and there is more need for operating the headlights and wipers, etc. Deep cycle batteries may be necessary. A good choice is the Advanced Glass Mat, AGM, types. Splitting the battery system in two, one for starting, one for running, can also be considered.

It is absolutely essential to have a voltmeter installed on the dash board, to monitor the condition of the battery system.

Split Battery System (Mercedes 300SD)

To split the electrical system is simpler than it seems. The glow plugs are fed from a relay box on the front left of the engine. Unscrew the cable coming from the fuse box and put in a new cable directly from the battery in the engine compartment.

Use AWG 4 cable for the high current. The relay box has its own fuse inside. On the front right side of the engine is a little black plastic power distribution box. It is fed from the forward battery and has cables going to the fuse box and the starter. Locate the cable going from there to the fuse box and extend it to the second battery, which can conveniently be placed in the trunk. There is a handy port to bring the cable through the firewall, located right behind the battery. An AWG 6 size cable seems adequate for this long run, which never carries a high current. To bring the cable to the trunk, it can be routed through the speaker in the right rear side of the car, where there is access to the trunk beneath it.

Make sure to protect the second battery with a fuse; a shorted battery can be very dangerous. Fuse holders are available from auto parts stores.

Also make sure to have good solid connections everywhere. If a connection is not very good, it will not pass through the high current needed to start the engine, even though everything looks fine when checking the voltages with a meter.

Cruise Control

The cruise-control emits EMF and should probably be disconnected. On the Mercedes cars, that is easily done by locating the actuator on the front of the engine, and disconnecting the cable to it.

On all models except the 300SD, the cruise control is operated by a moving magnet connected to the speedometer inside the dash board. The magnet is best removed.

On the 300SD, the cruise control is operated by an electronic control box, located in the driver-side footwell. Simply unplug the left of the two boxes. The right box is marked “warngerate” (warning device) and generates a warning signal if starting the engine without wearing the seat belt. It does not seem to do anything else.

The Auxiliary Fan

An electric fan is mounted on the front of the radiator, to assist the fan powered directly by the engine. The fan is automatically turned on when the engine temperature goes above 90 degrees centigrade. This may happen if the car is climbing a long hill. On very hot days, it may happen on long inclines or when idling, if the radiator is old. Mercedes offers a kit that upgrades the engine-driven fan for hot climates. Make sure the radiator is from Behr; some brands are not effective enough.

It is important to note that the fan consumes about 4 amps (48 watts), which taxes a solar powered system.

It is quite possible to drive with the auxiliary fan disconnected, it just requires monitoring the temperature gauge. With a good radiator, it should not be a problem.

Electronic Speedometer

The 300SD uses an electronic speedometer, while the other models have cable-driven speedometers. The 300SD speedometer works by pulses, that are generated by a magnet located in the very rear of the transmission housing. The pulses are transmitted in a cable that exits the rear of the transmission and goes into the car on the left side of the center console, right next to the driver's right leg. It continues up into the dash. The EMF from these pulses can be bothersome. The solution is to remove the magnet. A skilled mechanic can open the back of the transmission, take out the plastic part with the magnet, cut off the magnet and put the plastic piece back in again. A good mechanic can do that within an hour. To experiment, it is fine to drive around with the plastic plug dangling outside for awhile.

The downside of this modification is that both the speedometer and the odometer no longer work. It is quite possible to drive without these, and stay within the speed limit by watching the other cars. This approach may not work for people who insist on driving right at the limit.

Disconnecting the odometer may be illegal, as it can affect the resale value of the car. In some states, older cars are exempt from registering the odometer setting when the car is sold. The odometer in the 300SD was not well designed, many of them break somewhere after 150,000 miles.

Hot Water Valve

On the 300SD there is an electrical valve that controls the flow of hot water coming from the engine into the passenger compartment to warm it up in cold weather. When the engine coolant gets hot, and is not needed to heat up the passenger compartment, the valve closes. It consumes 0.5 amps continuously while closed, which is a strain on the battery.

On the 300SD, the cord to the valve can be disconnected and a 3/8 inch manual ball valve put in front of it, using an extra hose. Of course, then one has to open the hood to control the heating system, but that is fine in my warm climate.

The valve is hard to see. It is located right up against the firewall, just to the left of the battery.

The owners of 300D cars have apparently not needed to make this modification.

Degaussing Moving Parts

Moving magnets generate a magnetic field. That is how the alternator produces electricity, for instance. Some people have problems with the weak and low frequency EMF generated by magnetized parts that are turning around in a vehicle.

The alternator is intentionally magnetized to do its job, but other components in a vehicle can unintentionally become magnetized. It is often difficult, time consuming and expensive to locate and degauss car parts. Since it is very few of the highly sensitive people who are bothered by this, and the radiation generally less that all other sources, degaussing should be the last thing to be looked at. All other options should have been exhausted first, and the sensitive person stabilized, before entering this difficult area.

Car parts can become magnetized when exposed to a strong magnetic field for a shorter time, or a weaker one for a long time. Many parts receive a magnetization when they are manufactured or refurbished, especially if they are welded together electrically.

Moving parts are usually made of steel, which can be magnetized. Parts made of stainless steel, aluminum, copper or plastic cannot be magnetized.

To locate an area where there is a problem, use a gaussmeter while the engine is running. To check new parts for magnetization, before installing them, use a magnetometer. Make sure to check all new bolts, as they are likely to be magnetized.

If it is a diesel car, disconnect the battery while the engine is running, to omit any EMF from the electrical system. A gasoline car will need the battery to run.

A small handheld probe is very helpful in pinpointing the source.

Any moving part can be a problem, such as the fly wheel, the alternator, the torque converter, gears, hydraulic pump, etc. The tires can also be a problem, as the steel belts may have “hot spots” created during manufacturing. At highway speeds, they can become problematic.

Some tire brands (including "Michelin Symmetry and "Delta Esteem") seem to be produced with fewer magnetic spots that are easier to degauss.

To determine whether there may be problems from magnetized moving parts, do the following experiments:

- Let the sensitive person sit in the car for about fifteen minutes, with the ignition off. Then record all symptoms.

- Make sure the radio and other gadgets are turned off. Then turn on the engine and leave it in "park" or neutral. Let it idle for fifteen minutes, with the sensitive person sitting in the same place as before. Record all symptoms again. If the symptoms are worse, they could be from either electrical, magnetic or both.

- If it is a diesel vehicle with the alternator disconnected, turn on the engine without the sensitive person in the car. If there is no helper, try to start the engine while sitting in the back seat. Then disconnect the battery (and solar panel, if any.) Let the sensitive person sit in the same place as before, with the engine idling for fifteen minutes. Record all symptoms. If the symptoms have worsened, there is probably a magnetic problem with a moving part before the transmission, or a magnetic sensor.

- If the symptoms have not worsened in the above experiments, then try to drive the car. If the car is an alternator-less diesel car, leave the battery (and solar) disconnected, but do not drive on a public road, as all signals are inoperative. If it is first now that symptoms show up, the problem is likely to be a magnetic problem in the drive-train or the wheels. Try to experiment if it gets worse at higher speeds.

It may be best to repeat the whole experiment on a later day, to be sure.

Degaussing is both an art and a science, that takes an effort to get done right.

Emissions and Alternative Fuels

The emissions can be improved dramatically by using alternative fuels, either biodiesel or straight vegetable oil.

Biodiesel is available at some gas stations in certain areas. It can also be produced at home with some effort. Since it involves handling toxic lye, it is probably not a good project for someone with MCS. Biodiesel has the added benefit that it is a natural lubricant and fuel line cleaner, which should extend the life of the engine.

It is also possible to run the car on straight vegetable oil. The oil is too thick to run on its own in cooler weather, so a heating system would need to be set up for the tank and fuel line. With no electricity to spare, the engine coolant must be used, which will only work once the engine is hot. An extra fuel tank must then be used for start-up, or external heating used.

For details on biodiesel and vegetable fuels, see the book “From the Fryer to the Fuel Tank” by Joshua Tickell.

Even with these alternative fuels, the exhaust is not safe, just better.

Tales of Bad Repairs

Even though the older Mercedes cars are some of the most well-built cars ever made, they do break. Going to a Mercedes dealer is too expensive for most of us and a local mechanic can do a lot of the work, but it is important to know a mechanic who is very familiar with these models. Such a mechanic may be hundreds of miles away, but is sometimes needed, and he may be willing to give advice over the phone.

I’ve had my share of botched jobs. Little things, like the mechanic who told me that a cigar-shaped fuel hose was swollen and needed replacement, when it actually was made that way intentionally to make the engine idle more smoothly.

When I bought my car, I had a new radiator put in it. It was the right type of radiator, but only for northern climates. Come next summer, the engine would overheat on the steep slopes of northern Arizona. Getting a genuine Behr radiator put in was actually cheaper than the “cheaper” off-brand version.

My worst experience was when the transmission no longer would shift up from first gear. Three local mechanics looked at it, two of them transmission specialists, one of whom had rebuilt the transmission 14 months earlier. This guy sat on it for over ten weeks and did $300 worth of damage until I took the car back and had it hauled to a specialist in Prescott, 160 miles away. The specialist could quickly see that the problem was a valve that controlled the shifting set points, which are set by vacuum on the 300SD. That repair was inside the newly rebuilt transmission and cost $1,200, not including the towing.

If I ever have another failed transmission, I would not let a local shop do the rebuild, even when claiming specific experience. I would buy a rebuilt one from a specialist who will ship it to a local mechanic for installation.

Resources in the United States

TriField gauss meter, magnetometer, shielding, etc.

Less EMF Inc.	1-800-LESS-EMF
Safe Level	1-800-222-3003

TriField meter upgrade

Alpha Labs	1-801-487-9492

Mercedes parts (new, used and refurbished)

Performance Products	1-800-243-1220
MB parts	1-800-741-5252
Tristar Parts	1-800-522-4737

Solar equipment discounter

Earth Solar	1-800-329-3283
N. Ariz Wind & Sun	1-800-383-0195