The SilverLeaf Seminar

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Preface

I started giving seminars soon after I founded SilverLeaf Electronics. It wasn't as much a seminar as a sales pitch for my first product, the VMSII. But it was clear even from the first that there was a thirst among these RVers - a thirst for real knowledge about their coaches and how to drive them.

What soon became clear to me is that although the engine and transmission manufacturers happily gave seminars, those classes were mainly about maintenance. Those seminars were usually given by mechanics, only a few of whom had personal experience driving a motorhome. They talked about what they knew - which is admirable - but there was a real void at the rallies.

So it was inevitable that my own seminar would slowly evolve from a SilverLeaf sales pitch to something different. Today I talk mostly about how to understand the engine, transmission, and chassis and get the best performance, fuel economy, and much more. I'd like to think that this new seminar is an even better sales pitch, because I show how to get tangible benefits from our VMS products. And certainly our clientele appreciate it. My seminars are always one of the most crowded, and no one leaves until the end. (And sometimes not even then! I've had crowds stay for two and a half hours, asking questions all along.)

My personal expertise comes partially from years in the management of Safari Motor Coaches. My brother was the designer of the Magnum chassis, and with him I rubbed shoulders with experts from Caterpillar, Allison, Cummins, and other leading companies. I put a lot of miles behind the wheel of our coaches, taking coaches to rallies and sometimes on vacation. Of course I have some expertise in electronics - I didn't just create SilverLeaf Electronics, I serve as lead designer and even write much of the software. In the process I've learned a lot about the internals of the engines and other chassis components that even most mechanics don't know. And since SilverLeaf often does special projects for companies like Kenworth I'm always learning more secrets. But it has been the time behind the wheel that has contributed most to my seminar.

I founded SilverLeaf Electronics Inc. in 1998 because I saw an opportunity. Engines and transmissions were getting more and more sophisticated but the coaches weren't. Some of my inspiration came from seeing that a $30,000 tow car was often better equipped than the $300,000 coach that pulled it. Some of my inspiration came from my own experiences behind the wheel. And some came from my knowledge of the coaches and the potential of their electronic components.

Since that first year we have introduced a variety of monitors and accessories, and have begun integrating more components in the coach. I doubt any company in the RV world puts a greater part of its revenues into R&D.

This book is something like two booklets in one. First, I provide an outline of my seminar - perhaps not a verbatim transcript but a fair summary. Second, I have added dozens of little facts, some well known, some not, that I have collected over the years. Some of the facts serve to illustrate the points in the seminar. Others are simply things that I think people might like to know, and aren't necessarily tied to anything else in the text.

The Basics

At their heart, SilverLeaf's VMS products consist of just three things. First, they are a display - typically the brightest, biggest graphic displays you''ll ever find in a dash. They are big and bright for a reason - if you can''t read the display there is no reason to own the product. Our bright yellow electroluminescent (EL) displays use the brightest display technology available, bar none. Our color displays are the best of their breed. All our displays are fully graphical - so we can use every bit of the screen to make big, readable gauges.

The VMS is also a computer, complete with a small keyboard. Once again, the VMS products are designed to be used while driving. So the keys have a distinctive click, so it's easy to tell when you've hit them. And there is a rotary dial - like an old-fashioned volume knob - which is extremely quick and easy. The computer itself is quite sophisticated, and is constantly analyzing and storing the data it receives.

The third key part is the transceiver, which allows the VMS to talk and listen to the engine and transmission. The VMS does not contain a single sensor. All the data it shows is derived from information taken directly from the engine and transmission. Which means it is not only trivial to install, it provides the best possible information.

By "best", we mean three things: the most **accurate**, most **precise**, and most **relevant**. Even though the dashboard contains a variety of gauges, none can match the VMS data in these three ways. And when the dash gauge disagrees with the VMS, always trust the VMS first.

Lets start with relevance. The data for the dash gauges can come from a variety of sources. Some of the newer, better gauge clusters tap into the engine electronics like the VMS. But most use conventional sensors, mounted around the engine compartment. For example, most temperature gauges are mounted on the cooling system, external to the engine. (Notice how they say "Water Temp", not ""Engine Temp"!) The VMS gets its data from a sensor internal to the engine. So which more accurately reflects the

You'll rarely find EL displays in vehicles - they cost more than the car companies want to spend. You'll see them mostly in aircraft and medical equipment, where quality counts more than cost.

condition of the engine? The VMS, of course.

Conventional gauges are less accurate, as well. The sensors themselves merely generate a voltage, which is transmitted up a 40' long harness to a gauge which is essentially a cheap voltmeter. (Some use current, which is effectively the same.) Accuracy is limited by the quality of the sensor, the length and type of wire, the quality of connections, and the quality of the gauge. Both the gauge and the sensor are typically rated to within 5% - which means that even if the wiring is perfect, your coolant gauge can be off by degrees and still be "within spec".

The sensors within the engine are much more accurate - the internal temperature sensors are typically good to one degree. And the data is transmitted digitally, so there is no loss of accuracy there. And unlike a gauge, the VMS displays exactly what it reads. So our temperature readings are good to a single degree. Our tachometer is perfect - after all, the engine knows precisely how fast it is injecting fuel. All our readings have the greatest accuracy possible.

Precision is the final key. Look at a typical two inch coolant gauge and try to measure the angle between 200 degrees (a little warm) and 220 degrees (very hot). It can be impossible to tell while driving. (Many gauges don't even give the numbers. They simply have "Normal" and "Hot".) But the VMS reports the data with absolute precision. There is no estimation required.

So the VMS is more relevant. accurate, and precise. Which means as a driver you can drive with more **confidence.** Without a VMS, if the temperature needle budges even a little, you have to take action. You don't know with any confidence how close you are to an overheating disaster. But with a VMS you know exactly where you stand - and you can drive confident in the knowledge that you have control over your situation.

When a coach builder adds a sensor, he has little reason to buy anything but the cheapest one. After all, if the engine overheats it won't likely be his warranty that has to cover it. But the engine builder has a good reason to put a high quality sensor in his engine - the engine uses that data to protect itself from harm and meet the power and pollution specifications. A bad sensor will surely cost him money. So given a choice, whose sensor should you trust?

The trend among the coach builders (and car builders too) has been to "dumb down" the dash. Many companies feel they'll get fewer technical calls if they provide fewer gauges. SilverLeaf begs to differ. We feel smarter customers are a good thing.

You will never hear me say "Our VMS is so smart - it's smarter than you are!". Our products aren't designed to be smart - they are designed to make you, the driver, smarter.

The Art of Driving

The quickest way to survey the capabilities of the VMS products is to put it into “Scan Mode”. Here we have instant access to all of the many gauges. We can set the VMS to “scan” through the gauges - skipping the ones we want to skip, showing the ones we consider important. And at any time you can check any particular gauge just by turning the knob.

In the corner of the screen is a small arrow, indicating that the unit is in “Scan” mode. The unit will scan from item to item. Pressing the Scan button or turning the knob turns the arrow into a stop sign - indicating “Watch” mode. The unit will stay on this gauge until you turn the knob or press the Scan button.

Normally the gauge is displayed as a large number - as large as we can fit on the screen. Pressing the knob shrinks the number to make room for a “histogram” - a moving graph that shows how the reading is changing. For most gauges I prefer the large numeric display. But there are a few cases where it is as important to know how the reading is changing as it is to know the reading! I’ll give an example a little later.

Running through the gauges you’ll see everything from Accelerator Position to Turbo Boost Pressure. All the main ones are included - Coolant Temperature, Transmission Temperature, Speed, RPMs. Some are gauges that once were common on dashes but now are getting rare - Battery Volts, Intake Manifold Temperature. Some are items that have never before been seen in a dash - Torque, Horsepower, Power Factor.

Let’’s look at a few of these gauges. The Battery Volts reading is much more sensitive than any dash gauge, which means it can often show signs that the alternator regulator is going out. If this gauge starts to fluctuate from moment to moment, expect an alternator repair in your near future.

One of my favorite gauges is Horsepower - the VMS can actually calculate the engine’s approximate horsepower output as you drive. There is one important application for this gauge - **bragging**

I’ve heard the transmission expert in other seminars brag about how smart their automatic transmission is. Well, I don’t think it's smarter than the driver - it just keeps secrets! After all, does the transmission know how steep this hill is? How hot the day is? How many cars are lined up behind you, or slow trucks ahead? Of course not - so why should we trust it to always be in the right gear? No piece of electronics is smarter than an informed human.

Some may be surprised that some engines don’t report Oil Pressure. On engines like the Cat 3126, oil pressure is now irrelevant because of they have hydraulic fuel injection. If the oil pressure does head south, the injectors will lose pressure and the engine will shut down long before the engine overheats or suffers any damage. So on these engines Oil Pressure is no longer important.

rights! After all - you bought the horses - let's watch them run!

But as a practical matter, horsepower correlates mostly with fuel consumption. There is an old adage, "They sell us Horsepower, but we drive Torque". Torque is the single best indicator of engine performance, and if there was ever a gauge which deserved to be marked, "Performance", it is this. And, of course, the VMS has it.

Simply put, you want to drive to maximize Torque as much as possible. While cruising on a flat highway, the torque readings won't be meaningful because the engine is hardly working. But once the hills begin, watch the Torque and see how it responds to your actions.

You will quickly discover that all your driving instincts are probably wrong. We all grow up driving gas engines. Our first car, and probably our first motorhome, had a gas engine. And our foot and ears are trained accordingly. For gas engine love to be revved - they are designed to operate at high rpms. But diesels are different - they hate to be revved. They give us their best when they are allowed to operate at low rpms. We're not used to that, and so almost all of us need to "recalibrate our ass-ometer".

The VMS gives us an easy way to do this. By watching Torque as you drive through the hills, you'll be able to quickly train your ear and your foot to eke the most performance from your engine. Almost all drivers have a tendency to shift down too early, and to rev up at the base of each hill. These strategies waste fuel and add wear to the engine, and don't get us up the hill much faster.

Further proof of this can be seen in the Power Factor. This gauge shows the raw efficiency of the engine - the amount of power obtained from the fuel. Like Torque, it generally decreases as the RPMs rise. Unfortunately, Power Factor is only the raw engine efficiency. It doesn't consider wind resistance, parasitic loads, rolling resistance, and so on, so it doesn't give a complete answer to the fuel efficiency problem. But we'll get to the real answer a little later.

Some engines also leave out Oil Temperature. Oil Temperature was once important, since it would start to rise well before the Water Temperature gauge. But today these two reading march in near lock-step, and two gauges are no longer necessary. And as for which is more relevant, Oil or Water Temperature, keep in mind that every engine builder uses Water Temperature to trigger the engine "self-preservation" modes. Caterpillar, Cummins, Navistar, and Detroit Diesel all seem to agree Water Temperature is a better indicator of potential engine damage.

Quit idling your engine so much! There is only one reason to idle your engine after running it - to let the turbocharger cool. And usually this isn't necessary at all. So if you've heard that you should always idle for five minutes before shutting down – balderdash! After a hard drive, before shutting down turn the VMS to Intake Manifold Temperature. Idle the engine until it reads within 40-50 degrees of the ambient outside air temperature - on a 90 degree day that means 130-140 degrees. Shutting down when it is hotter than this will cause the Turbocharger to bake in its own heat. Watch your VMS and you won't go wrong.

But now let's consider perhaps the most important topic that all RVers face - heat management. Successful heat management is a matter of understanding the physics and having access to accurate information.

The first thing you need to know is the limits of the system. Most engines today are programmed to trigger the "Check Engine" light at 226 degrees. At a few degrees more they will start to "derate", or automatically reduce the throttle to protect itself. But they will run - without damage - at any lower temperature indefinitely.

The second thing you need to know is the basic heat equation. It is very simple: the amount of heat generated has to balance the amount of heat "rejected" by the cooling system. If the equation is out of balance, the temperature will rise.

Thus the real goal of heat management is not to run cool - that simply is not a realistic option when you are climbing a hill on a hot day. The goal is to balance the equation. And the way to do this is to use that histogram we talked about earlier. If that graph is level, the temperture is stable, and the heat equation is balanced. But if the graph is jumping, the equation is out of balance, and you need to take action.

I believe in starting the process when I see the temperature reach about 205 degrees. My goal is to stabilize the temperature in the 210-215 degree range, which leaves me with at least a ten degree cushion should the engine need it. The tools I use to do this all relate to the heat equation.

On the one side, I want to reduce the amount of heat generated. The most obvious way to do this is to burn less fuel. But fuel burn isn't the only source of heat. The turbocharger is a small air compressor - and like all compressors it generates tremendous amounts of heat. If you can reduce the use of the turbocharger, you will dramatically reduce the amount of heat it produces. Thus the key "leading indicator" that you need to watch is Turbo Boost Pressure. Managing the turbocharger requires a steady, attentive foot and a bit of patience.

It is a simple fact - modern engines run hotter than their predecessors. The reason is simple - hotter engines are more efficient and produce fewer emissions. That is a key reason why the older engines won't pass the newest emissions requirements. It is also a major reason why the modern engines are all electronic. The electronic controls monitor the heat and try to protect the engine from overheating.

On the other side of the equation, we want to increase the amount of heat rejected by the radiator. There is one simple way to do this: increase the RPMs. This will increase the fluid flow through the system - in some cases it also increases the fan speed - and thus increase the capacity of the cooling system. There is one effective way to increase RPMs - gear down.

So the heat management routine can be summarized as a series of cycles. Monitor Turbo Boost and Coolant Temperature (at least!), and as the temperature rises past about 205 degrees, start nursing the pedal to reduce the use of the turbocharger. If this isn't enough to stabilize the temperature, gear down. Again, nurse the pedal, minimize the boost pressure, and if the graph still refuses to flatten, gear down again. Only the hottest, toughest conditions should require more than two downshifts.

By now you may have noticed the paradox. A moment ago I talked about minimizing RPMs to get the best engine performance. Yet now we are talking about maximizing RPMs to get the best cooling. So which is "right"? Both, of course, according to Perlot's Law of Driving:

Driving,
like Marriage,
is the Art of Compromise.

It is up to you, the driver, to make those compromises as you see fit, weighing all the factors - weather, topography, schedule, finances, boredom. Again, the purpose of the VMS isn't to tell you how to drive, but to give you the information you need to be a better driver.

Another compromise that we are all familiar with is the trade off between Speed and Fuel Efficiency. And here is where our Rolling MPG gauge is invaluable. The Rolling MPG takes about a minute to get "dialed in", but once it does it provides a very accurate indicator of your fuel economy on this patch of road, with this headwind, this hill. Use it to adjust your driving to the current conditions, and get the best fuel economy possible.

Is this all hype? One gentleman wrote us a letter saying that he was disappointed with his rig's performance, and was going to buy a aftermarket performance package. But he bought a VMS 200 instead, and he is tickled pink. With the VMS he has learned how to get all the performance he needs from his engine, and no longer feels any need to add an aftermarket kit.

One valuable exercise is to find a flat stretch of freeway, preferably on a calm day, and use the Rolling MPG gauge to discover your “fuel curve”. Start by setting the cruise control on 55 mph, and drive for about a mile. Check the reading. Then bump the cruise up a couple miles per hour, drive another mile, and check again. Keep doing this to as high a speed as you are comfortable driving. You now have the information you need to draw the “fuel curve” for your coach. You’ll usually discover that your fuel economy starts to really plunge when you reach a certain speed, so you’ll want to cruise just below that speed as much as possible. Of course, at any given moment you”ll need to adjust for winds and hills, and the VMS will help you do that.

While you are watching the Rolling MPG, pay attention to some of the other gauges - you”ll quickly learn how they can affect each other. One of the main fuel-wasters is the turbocharger, and as the Turbo Boost Pressure rises, the fuel economy falls dramatically. A soft touch on the pedal will help keep the Turbo Boost down, and the MPG up.

A second factor to watch is the engine RPMs. Just as we discussed with hill-climbing, the engine is most efficient at low RPMs. As RPMs rise past the sweet spot in the engine’s fuel curve, its efficiency declines. (It also increases engine wear.) This is why “taller gears” - that is, a lower rear-end ratio that requires fewer engine revolutions per tire revolution - will improve your fuel economy.

It is also why one of the biggest fuel-wasters is a transmission that wants to downshift too early. The Allison 6-Speed is notorious for this - in its default mode it will shift down to fifth gear on virtually every rise in the road. The best way to limit this is to put the transmission into its economy mode by pressing the ““Mode” button on the shift console. This will reduce the downshifting considerably. The way to completely eliminate them is to turn the cruise control off and train your foot.

The Rolling MPG is particularly handy when you see the sign that reads, “Next Diesel 200 Miles”, and you have 20 gallons left in the tank. You may be surprised about how much fuel you can save by nursing the Rolling MPG - and when you have the proper motivation!

Many drivers believe that the best way to better fuel economy is to just set the cruise control and leave it alone. This is a myth. Granted, the cruise control will help the heavy-footed driver keep some discipline, but even the best cruise control won”t respond well to the natural variation in conditions as you drive. An attentive driver will always get better fuel economy than any cruise control.

Engine Diagnostics

One of the greatest benefits of electronics is their ability to provide immediate diagnostic feedback. The engine ECM (Electronic Control Module) is constantly monitoring dozens of components, and can diagnose hundreds of different kinds of failures. Unfortunately, it isn't very good at sharing all this information.

Let''s illustrate with a story - one that everyone has heard in one form or another (if it hasn't happened to you yourself!). There are many variations, but they all run something like this:

It's a warm summer day, and you're working the coach through the mountains, a hundred miles from nowhere. Then you see it - the little light at the center of the dash come on - the one that says "Check Engine".

Now what can that possibly mean? You check the gauges, you listen for noises, you look for smoke. But you can't possibly tell what is wrong.

So of course you start looking for a place to pull over, and it usually works out that the moment you find a wide spot to pull out, the light turns off. But you pull over anyway, check the oil, check the water, shrug your shoulders, and drive off again. And maybe it happens again, maybe not. And eventually you get to a town where you can take the coach to the engine mechanic. Who dutifully plugs in his computer and says, "Nothing wrong now. Have a nice day!"

And of course, at that moment nothing is wrong. Intermittent problems mostly occur when the engine is under stress. When the engine is in the shop, the engine isn't under stress - you are! So the engine checks out fine - and you have no choice but to drive out with the same problem unresolved.

In one version of the story I heard, a gentleman ran through this scenario three times. The third time around he was able to cajole the mechanic into taking a drive with him, with the service tool plugged in. It took ninety minutes, but finally the light came on, the mechanic read the code, and they returned to the shop and got it fixed.

Check Engine? Yep, I checked it and it's still there! Thousands of dollars of state-of-the-art engineering and electronics, and when something is wrong all it can say is "Check Engine"?!

There is a misconception that the engine ECM remembers faults and the service tool can pick up this history. This is partially true. The details vary from engine to engine, but generally the engine ECMs only record specific types of faults - overheating, overrevving - the types of faults that could help the engine builder get out of a warranty claim! They don't record most of the routine faults that would help the most.

With a VMS, the story is a bit different. Now, when the light comes on you simply press a button on the VMS and you get the diagnostic information immediately. Not just the codes, but a plain language description. Now you can make an informed decision about what to do - call a tow truck, nurse it in, or drive on. If you aren''t sure, you can call the engine service hot lines and ask them. And they''ll be able to give you a real answer that you can have some confidence in.

The VMS also keeps a record - recording not just the fault, but also data like engine RPMs and Temperature that can be used to establish a pattern. Now when you drive to the engine shop you can show them exactly what happened and when. The mechanics love it - they have real information and can go to work solving the problem, instead of stabbing in the dark.

Of course, there are limits to the system. Not every fault can be detected by the engine controls, and sometimes the information isn't complete. For example, the ECM can report that the fuel pressure is inadequate, but it can't tell you whether it is because the fuel filter is plugged or the fuel pump is leaking. But at least you have a good idea of the type of problem and where to look for the solution. In general, the closer the problem is to the ECM, the more specific the diagnostic information. Electrical problems - formerly the most frustrating of all engine problems - are usually isolated down to the particular wire. Bad injectors are identified by number.

Perhaps the most common intermittent fault is a bad injector. In fact, when a driver reports an intermittent fault and a rough-running engine, many shops will start swapping injectors randomly. (They can usually get the work covered under warranty, and it gives the customer the feeling that they are doing something.) One fellow"s story is that the first time he went in they changed injectors #1 and #2. A month later they changed #3 and #4. A month later they changed #5 and #6. Of course the bad one is the last one they changed.

Other Useful Things

Each VMS has so many features that we simply can't go over everything in a single seminar. But we can hit some of the highlights – including the very nifty Trip screens.

The first time you press the Trip button, the VMS displays the Trip information. As you might expect, this includes the distance traveled. It also includes the time and fuel used, plus the average speed and of course, MPG. The time is *engine running time*, and includes engine idle time, but does not include any time when the engine is not running. The fuel consumption is just for the engine – it ignores the generator and furnace. Thus the MPG is the honest miles-per-gallon that your engine is getting.

To zero out the trip and start anew, just press the Clear button.

At the bottom of the screen is a trio of indicators: Miles to Go, Gallons to Go, and Arrival Time. This is a simple and useful day planning tool. Simply use the knob to dial in how far you plan on driving today (press the knob to quickly add a 100 miles), and the VMS automatically calculates the amount of fuel it will take and the time you will arrive. As you drive it counts down the miles and constantly updates the fuel and time requirements. The numbers are based on your averages for this trip. For the first few miles of a trip it uses 50 mph and the engine's aggregate MPG. As a result, in the first miles of a trip you will see some variation in the Gallons-to-Go and ETA, but the longer the trip the more accurate it will get.

(Of course it isn't psychic. It has no idea that you are about to hit road construction or stop for lunch.)

If you press Trip a second time you get a second Trip screen (surprise!). This is like having a second trip odometer in your dash. It's completely independent of the main trip screen so you can reset it any time you like. (Some models even have a third trip odometer.) Most folks use the first trip screen for their actual "trips" – that is, from when they leave home to when they get back, or from rally to rally. Then they reset the second trip screen every time they refuel. The

When the old codger protests, "I don't understand computers", this is your chance to show him how easy the VMS is to use. Ask anyone to look up the trip information. Of course they'll look at the buttons and press the one marked "Trip". What could possibly be easier?

Our experience is that the accuracy of the fuel consumption numbers vary with the manufacturer and engine type. Cummins tends to be "optimistic", and their engines often understate the fuel consumption by 2-3%. Caterpillars are much more accurate, and their HEUI engines like the 3126 are absolutely dead on.

fuel numbers on the trip screen are far more accurate than the fuel gauge on the dash, so this becomes their primary fuel gauge.

Pressing Trip again provides another bonus – a history of every trip you've taken. Every time you clear out the main trip odometer, the VMS doesn't throw the data away. It stores it on this screen, which shows the date the trip ended and all the trip information. You can throw the little notebook away – the VMS can store over 4000 trips in its permanent memory.

One of my personal pet peeves is this: We spend all that money to buy a gorgeous coach, appointed with fine upholstery, sumptuous leather, rich custom woodworking – and the first trip out we stop at Camping World and get a cheap $5 clock and sticky-tape it to our dash. What are the coach builders thinking? That's why the VMS provides a nice clock screen, which includes the day and date and even an alarm clock. It's our way of stealing a little business from Camping World.

The Maintenance Tracking system is a simple way to keep up on the routine maintenance. We pore over the maintenance recommendations provided in your chassis manuals (we have most RV chassis programmed in.) and divide the recommendations into logical groups that you normally do together. When you perform a particular service group, you simply select the group with the knob and press the Clear button. The VMS then records the date and odometer reading, and tells you when you need to do it again. Different symbols let you see quickly which items are due . . . or overdue.

For the pilots we devised a "Pre-drive Checklist", a list of all the many items you might want to check before you move the coach. (Not that I *personally* have ever driven off with the TV antenna up, but I have heard stories about others who have.) The list can be customized – simply press Clear to remove an item from the list.

Another excellent feature is the Metric support. You can set any or all your gauges to Metric, and also the trip information. (On most units this is accomplished

Remember that the fuel numbers on the VMS are only for the engine, and don't include any consumption by the generator or diesel furnace. Of course, these items are usually only a small part of the total consumption.

I like to point out that the most complicated feature of the VMS is the clock. If you can set the clock, you can do anything on the VMS. And I'll run people through the process to show them how the knob and buttons work. Once they see how easy it is, they enjoy their VMS even more.

The clock is good to within about 2-3 minutes per year.

by pressing Clear while the gauge is on the Scan screen. The Trip units are changed on the VMS Settings screen.) For most of us, we use metric only when we are in Canada or Mexico. You can set just the Speedometer and Trip Info to metric, drive along without getting a speeding ticket or running out of fuel, and then set the gauges back to English when you reach the border again. The VMS won't miss a beat.

The Next Generation of SilverLeaf

With all the great things happening at SilverLeaf, it's not surprising that people tell me that I'm going to be the next Bill Gates. They couldn't be more wrong. I am not nearly smart enough.

Mr. Gates is a master at getting people to buy new computers year after year after year. It's a great idea, and I for one have enriched the man at least a dozen times just for my personal computers - and even more for by computers at the office. I'm not that smart. I have an old-fashioned attitude about how long things should last, and I believe that a VMS shouldn't be outdated before the motorhome is.

But technology marches on, and SilverLeaf keeps coming out with new gadgets. Surely you will eventually want to add something like the Weather Station or Power Management system, and whatever else SilverLeaf comes out with in the future. As much as the coach manufacturers want you to buy a new coach every time we come up with something new, you really don't have to.

That is because we've designed every VMS to be upgradable - even without removing it from your dash. A technician with a laptop computer and special adapter can reprogram your VMS - it takes about 15 minutes - and immediately you are "up-to-date". You get all the new features of the latest units, and you can add almost any of the accessories. Amazingly, there is no limit to the number of accessories you can add - thanks to our clever "multiplexing" architecture.

The list of accessories is always expanding. One of the most popular right now is our Weather Station, which provides the temperature, humidity, heat index, barometer, altimeter, and compass all in one package. We also have a Road Temperature sensor that uses an infrared "eye" to scan the actual surface temperature of the road. This is a godsend in the winter - or any time of year in the high mountains.

Some of the accessories are aimed more at new coach builders, simply because they can be hard to install after the coach is built. These include the Total Power Management system, which does for the

At any given moment, not all accessories or features may be available on all VMS models. This is because our software development efforts go in cycles, with each model getting attention in turn. And eventually even a VMS may become obsolete - our commitment is to putting off that date as long as possible.

Software-only updates are a $95.00 service, the proceeds of which go to the technician. This helps defray the expense of sending technicians to rallies, and we try to get technicians to as many rallies as we can.

inverter/charger and generator what the VMS does for the engine - it tells you about your loads, amps, rpms, and volts and provides plain-language diagnostics. Plus it includes a battery autocharging feature that automatically starts the generator to maintain your batteries. It can be set to exercise your generator when the coach is in storage. It even understands quiet time, and is smart enough to top off the batteries just before quiet time begins so you don't run out of power in the middle of the night.

We also have accessories that will monitor your tank levels using pressure sensors - they are accurate to a percent or two and can’t be fouled. Our ultrasonic fuel tank sensor is just as accurate, and lets the VMS provide that wonderful miles-to-empty feature that we love in our tow cars.

We don’’t usually comment on our future plans, but you can be assured that we are constantly working on new products. Some on the docket include on-board scales that let you weigh the coach in seconds - without leaving your driver seat. Tire pressure sensors are on the horizon - just as soon as we can offer a system that can cover all your axles, plus your tow car. Since we also do business with Kenworth Truck we are in a good position to see the latest technology in other heavy vehicle markets, and some of that technology gets turned into products for motorhomes.