MECHATRONIC REMANUFACTURING
The Sustainable Service Solution for Past Model Automotive Electronics Support

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Automobile electronic control modules must be serviced for a minimum of 10 years as committed by the OEM’s with a potential life of 15 or more years. Collector vehicles such as the Corvette, Viper, or Mustang have service requirements for 25 years. Although electronic control modules have a low failure rate, their vehicle content level in 2007 averaged 16 modules per vehicle and is expected to increase to 35 modules per vehicle in 2010. This content level affords itself to requiring a long term service plan for electronic control modules. Typically, microprocessor, IC, EEPROM, and network manufacturers such as Freescale, STMicroelectronics, and Intel, do not have the volume requirements during the service life of vehicles to maintain a production line suited for producing these components.

The normal mode of operation is to produce these components until they reach a service level, typically below 20,000 pieces required annually and offer an “end of life” purchase or a “last run” of the component (ref. Exhibit 1). This typically occurs in year 6 or 7 of the life of the product, although it has occurred even prior to the vehicle going “past model”. Most electronic control modules utilize 4-8 custom produced microprocessors which offers a level of protection from competitors and gray marketers efforts of copying a design and replicating the electronic control module. These microprocessors are very often limited production quantities and are usually the first components to be offered as “end of life” production. The challenges are multiple; the first determination must be made as to how many components are expected to fail during the life of the vehicle parc or at least the ten year commitment. Determining this is somewhat of a crystal ball approach. Utilizing the vehicle production build numbers coupled with warranty rates and comparison results from past experience will result in an educated guess. The second challenge is storing the microprocessor for more than two years. Many component manufacturers suggest that nitrogen storage of the components is the best long term solution, however, there are arguments that this storage does not effectively protect against the degrading of the components solderability beyond two years. The third challenge is to maintain the production line within a plant to produce service product for the past model vehicles. Typical electronic control module production lines are 450 feet in length and utilize a series of “pick & place” machines along with 10 zone ovens and wave solder machines. Maintaining this production for less than 10,000 pieces when it was previously producing 100,000 pieces when it was current production, along with sporadic product requirements and retaining trained employee’s is not an economically sound decision and reduces plant efficiency levels along with square foot profitability loss. Although it is possible to reverse engineer a microprocessor, it is astronomically costly and usually time prohibitive. The average cost to reverse engineer a microprocessor is approximately $750,000.00 USD due to the average microprocessor having one million inputs and outputs that must be traced to duplicate the component. The lead-time for such a process is in excess of nine months.

The strategy of remanufacturing the product will eliminate the necessity to maintain a production line and maintain the servicing of the product through its ten-year life and beyond. The remanufacturing strategy limits the “end of life” purchase of components which can easily exceed a half million dollars, and brings it to an affordable level. In addition the remanufacturing strategy reduces the impact of discarding failed units into waste landsfills thus reducing the impact on the environment. Remanufacturing of electronic control modules is controlled by the availability of cores or the old unit removed from the vehicle. A collection system must be in place to maintain the constant return of failed units in order to sustain the remanufactured program. Due to the fact that the core is a failed unit that has
Corteco Partners with Sercore to Offer Electric Power Steering Technology to the Automotive Aftermarket

Milan, Ohio - To meet the growing demand for servicing Electric Power Steering (EPS) systems, Corteco, the aftermarket business of Freudenberg-NOK Sealing Technologies, has partnered with Sercore Tech S.L. of Madrid Spain, in an exclusive distributor agreement. The new partnership reinforces Corteco’s commitment to be the “Solution Provider” for the power steering aftermarket, making it as easy as possible for customers to adopt new and advanced technologies that improve their business.

The partnership will allow Corteco to offer new diagnostic equipment and technology to address the growing aftermarket demand for electric power steering as it replaces traditional hydraulic power steering systems. The growth of electric power steering is due to more stringent fuel consumption requirements and advances in driver assistance steering systems. Forecasts for the year 2020 estimate 50% of the world’s vehicle production (approximately 85 million units) will utilize EPS, compared to 30% of the world’s vehicle population in 2003 (20 million units).

Corteco is now sole distributor of Sercore’s patented Vehicle Emulation and Diagnostic System (VCarSys), a diagnostic device that simulates the electronic communication signals between systems in a vehicle during different driving conditions and allows for diagnosis of electronic systems not mounted in a vehicle. In addition to providing the VCarSys for diagnostic and emulation purposes, Corteco will now provide high-quality remanufactured EPS systems, and EPS rebuild kits. This complete product offering will provide customers and distributors with the ability to quickly enter and service the new EPS market by offering them multiple solutions, depending on their comfort level. “We’re excited about our partnership with Sercore,” said Jason Meier, CEO for Corteco. “They’re a technology leader in EPS which complements our EPS product offering for most European and some U.S. applications, with more in development,” added Meier.

“The whole team feels very proud that Corteco has chosen Sercore as a partner for this big project. We have worked hard for many years to research and develop new EPS remanufacturing processes in order to be at the forefront of this new steering product line. We’re confident that Corteco is our best possible partner for the present and the future,” said Juan Iglesias, Owner, Sercore Tech S.L.

Corteco is a division of Freudenberg-NOK Sealing Technologies (Freudenberg-NOK) the Americas joint venture between Freudenberg & Company of Germany and NOK Corporation in Japan. Founded in 1989 under the legal name Freudenberg-NOK General Partnership, Freudenberg-NOK is a leading producer of advanced sealing and elastomeric technologies for a variety of industries including automotive, aerospace, appliance, diesel engine, agriculture, construction, heavy industry, and alternate energy, among others. Freudenberg-NOK’s TransTec® brand transmission and power steering kits are manufactured by Corteco in Milan, OH, USA.
Angled Hindsight

Nick Staub, of Romaine Electric

They say hindsight is 20-20. With the changes we’re all experiencing in the industry, it sure would be nice if we had that clarity today. I think we can get that view if we look back and sideways.

The rotating electrical portion of the Auto Parts industry is far less mature than the general auto parts industry. I have watched mega companies like Denso well…..FREAK as they enter the world of volume auto parts distribution. The level of competition and razor thin margins are balanced by gianormous volumes and shaky A/R. Not a place for the weak of heart.

I believe the general auto parts industry is about 20-30 years ahead of where we are today in the rotating electrical field. Yet we are definitely related parties. Perhaps we are like that uncle they don’t talk about. If I’m right, which would be galactically unlikely according to my wife, co-workers and children, how can we look in the auto parts rear view mirror to see what is in store for us?

To answer this you have to remember what the auto parts industry was like in the mid 70’s thru the 80’s. In the mid 70’s there were tons of independent auto parts stores. There were very few, if any, programmed jobbers. That was what we called NAPA stores. They had gone into a program. The independent stores of the day shopped their W.D.’s against each other to get the right deals and they ran their businesses the way they wanted to. The independent store owner was king.

Yet as time progressed, the independent parts store began to lose its ability to leverage its purchasing volumes as effectively with the W.D.’s. Certain W.D.’s began to say “if you choose to buy from the other W.D. Down the street, then I will sell directly to the garages that you sell to”. To which the parts store owners said “then we’ll never buy from you, you no good &@%”!

The parts stores began to have to choose alliances more strictly. They couldn’t support those who would compete with them, that was a given. That alone reduced the number of vendors they could play against each other. Loyalties to certain W.D.’s actually helped some independent owners because the W.D.’s gave them extra discounts for increased purchasing. The kingdom they once enjoyed was not quite as cushy as it used to be, but it was still better than being a peasant.

The industry evolution was only beginning however. W.D.’s that didn’t sell direct to garages watched those that did and thought “hmmm look at those guys. They’re selling to the garages for less than the parts store was, but higher than what they sold to the parts store for. They are cutting out the middle man and increasing gross profit at the same time!” This caused a couple of reactions. One was that more W.D.’s began to “cross the line” and sell direct. The second was that the W.D.’s who chose to be loyal to the parts stores started to flat demand the parts stores purchasing loyalty in exchange for the suppliers market loyalty to the distribution chain.

Now the kingdom was definitely under attack.

This is when program parts stores really began to take over. It was the only safe harbor for many independent store owners. Their loyalties were being demanded from all suppliers and they only had so much to go around. Kinda like the finger in the dike theory. Once both socks are off, you’re options are truly limited. Anyway, as NAPA developed and Carquest entered the fray, the independents chose their dance partners or died. Although they gave up some independence they received many benefits. Many were hand held into the computer age. They were sharing information and learning ways to make their businesses more efficient. They spent more time selling parts and less time shopping vendors. The store owners were still the customer and they still had independent blood coursing through their veins. They would not always fall in line and occasionally they would buy outside the program. But not so much that it jeopardized their “membership”. That was the inception of true partnering in the automotive industry. Both parties brought something significant to the table. Supplier brought product, data, and advertising among other things. The independent store owner brought the financial investment, entrepreneurial drive and the relationships that it had forged over many years. Now the kingdom was permanently changed, new flag and all, but big brother is there now to help light the way and we can still shake our independent tooshies when we want.

— continued on page 11
In a thread of discussion we had lately a rebuilder was having problem using a T-801 Taditel regulator in a 3G Ford alternator application. The installation was unique, as this alternator went on a Limousine type vehicle and was wired to run a battery bank and accessories. This led the rear and entertainment part of the vehicle and was totally independent from the limo’s main alternator and charging system.

To simplify the installation and wiring to the alternator, they were using a +B to the “A” terminal and a +B ignition feed to the L/IG terminal of the regulator with no other connections. There was no warning light wired into the system, thus the lack of “S” (stator) wire looping from alternator to the regulator to turn off the warning light was not an issue.

Apparently, the set-up worked for a while until the alternator wore out and needed to be rebuilt or replaced. A new Taditel T-801 regulator was used, but the alternator failed after a few days of operation. I believe the problem was caused by the unorthodox wiring arrangement of the vehicle, specifically applying an ignition feed to the L/IG pin of the regulator and lack of stator (a phase) to the “S” terminal of the regulator. This requires a little explanation as to the peculiarity of Taditel regulators and the way their operation differs from any aftermarket equivalent.

Taditel’s regulator chip is based on the same design used for GM applications, that is to say it switches the field current at 400 Hz (cycle per second) and runs as a “B-circuit” operation. This means the regulator applies field current and does not toggle the field current on the ground side, as the “A-circuits” regulators do.

The Taditel regulators also have a feature called “Field strobe”, meaning upon activation and before the engine start, it applies a fixed 30% duty cycle (consider it as 1/3 of the field current) and after the engine starts, it looks for a “Phase” signal or stator signal. Once the stator signal is present, the regulator goes into the normal operation. If due to an internal alternator problem the “phase” signal is not generated, the regulator remains at 30% duty cycle and with no voltage control. (Figure 1)

Now if we use this regulator in a 3G Ford alternator and do not connect the stator (S) wire loop from the side of the alternator (STA) to the regulator middle terminal, we will be forcing this regulator to “field strobe”, meaning run the alternator with less than 1/3 of the field current and no voltage control. If the load was high, obviously the alternator would not keep up, and if the load was really low, the alternator can actually over charge the battery with is 1/3 field current that is being strobed by the regulator.

So when using Taditel T-801 or T-802 regulators (both for 3G applications), make sure the stator wire is connected, and avoid applying direct +B to the “L” terminal of the regulator which will cause internal damage, and will shorten the life of this highly reliable regulator.

**What’s up with 11231 Alternator?**

This alternator that was/is commonly used on Chrysler and Dodge cars as well as many Jeep trucks since 2007 until recently is becoming a good mover but at the same time, our ability to economically rebuild this alternator is diminishing due to damaged cores.

This alternator is used mainly on Chrysler’s 2.4L engine but recently it is also showing up in some 2.0L engines, especially in Jeep applications. It does not contain a voltage regulator (PCM-controlled) and is equipped with a Litens (Tendeco) 920810 OAD (Over-running Alternator Decoupler) type clutch pulley.

Usually the 100% of the cores we receive have ruined or locked up OAD clutch pulleys. And also a great majority of them have ruined DE housings, blown apart rotors, destroyed stators, and torn apart rectifier and brush holder assembly. In other words, the core is completely destroyed and not rebuildable. (Figure 2)

The cause is attributed to many things but mostly by a very high torsional vibration that is inherent on those engines, particularly the 2.4L. I suppose this is the reason that the manufacturer (Chrysler) being aware of the problem had installed a Litens OAD on these alternators to alleviate the problem from the beginning. The OAD pulleys do the job they are designed for well, but of course after many years of operation they fail, and if not caught on time, they will lock up and the alternator will subsequently fall apart.

On those rare situations that the alternator core is not exploded and is rebuildable, the use of an OE quality OAD (by Litens) is absolutely a must. This is not to say any other brand would not work; but seeing what happens even to an OE clutch pulley that is designed with the engine vibration characteristics in mind, one can only imagine how long an aftermarket replacement would last. A replacement may get the car going, but it would not be too long before the alternator will be damaged with the added possibilities of broken belt-tensioner, thrown off belt, and all sort of collateral damages that may result from a sudden alternator lock up.

**Fusible Links!**

We know that hi-current circuits require solid and clean connections. As more amperage flows through a connection, better and cleaner that connection must be to prevent excessive voltage drop. A good example is the battery cable-ends. The high starting current requires clean connections to allow the initial surge of current, while a poor connection will be a cause of dragging starter.

Fusible links that carry higher currents of various loads or the alternator output are subject to the same connection issues. Fusible links are usually an uninterrupted circuit between the power source and a break-out point, but in some designs this is not possible and some sort of blade connectors are used for routing the power.

A case we had lately was an early 90’s GM vehicle that the owner said at times it stalls, as if someone has disconnected the battery. But after siting for a while, things become normal and the car starts and runs.

After a detailed inspection of the system and routing of the power circuit, the power connectors were located near the battery. Once opened up, the overheated and melted connector was an obvious indication of the problem. (Figure 3)

The replacement connectors are not individually available, and replacing the whole engine harness assembly is beyond the economics of the repair. So we bypass them with separate length of fusible which puts the car in working order and on the road.

Such circuits that relatively carry high DC current, being either on the power or the ground side of any circuit are always a good starting point for diagnostic, particularly if the problem is in intermittent nature.

**Mercury Sable’s Lighting and Fuse Box!**

This segment is likely to be of interest of our Mechatronic members as well as my regular readers. We had this 2000 Mercury Sable that the owner’s complaint the head lights were not working, as well as a sounding alarm horn in random, and mostly late at night which immensely annoyed his neighbors!

The issue with the headlight was simply a defective switch and melted switch connector which was repaired with a new headlight switch and a new connector. The random alarm horn issue, however we could not duplicate it in the shop, but going by past experience, it could have been due to sticking door pin switches that are built into the door handles. In such cases, our first attempt is to lubricate each one and free them up, and if the problem persisted, replace them. Since door pin switches are about $40 each, the option of cleaning and lubricating them is a good first start. In this case it worked and we did not hear anything about the alarm horn going off again.

About week later the customer returned the car, asking if we could fix his Auto-Lamp. This option
that is usually bundled in a sort of luxury accessory package enables the headlights to come on when the it gets darker beyond certain point, and relieves the driver from turning his light on manually!

As much as we tried to convince the customer of the complexity of the system, he insisted he wanted it fixed, or at least giving him a repair estimate after the diagnostic.

The Auto Lamp system in this car is rather sophisticated. It has a “Photo-Cell and Amplifier” unit that senses the light’s intensity, connects to the BCM (Body Control Module), that is called GEM (Generic Electronic Module) in Ford vehicles. When the right signal is delivered to GEM, it activates the Auto Lamp Relay and turns on the headlight, regardless of the position of the manual headlight switch.

It should be noted that the headlights in this vehicle are controlled on the ground side. That is to say each headlight receives a +B, and either manual headlight switch or the Auto Lamp relay completes the ground circuit, as shown in Figure 4. This is opposite of the way most vehicles operate the head lights.

So we had to determine that GEM is turning the relay on under the right condition, meaning enough darkness that we could easily simulate by covering the photo-cell located on the top of the dash under the windshield. GEM is plugged into the back of the fuse box, and together they constitutes one single unit (Figure 5).

By separating them from each other momentarily, identifying the pin 25, and inserting a thin wire into this circuit to monitor the GEM activity and plug them back in, we made a test point and determined that the GEM is doing its job and is pulling the line down to operate the Auto Lamp relay. According to all published diagrams, the Auto Lamp relay is shown to be located on the fuse box. This turned out to be another challenge, as after a long research and head scratching, we found out it is not on the fuse box but built into it. It is not a replaceable item until the entire fuse box that is called Central Junction Block (CJB) is replaced!

This was relatively good news because if GEM was the problem, finding a new would have been difficult as Ford has discontinued supplying this item.

Due to high cost of new CJB, a used one was procured and when installed and everything hooked up, the Auto Lamp feature worked fine. A tear down of the old fuse box showed the damaged irreplaceable relay on the circuit board. (Figure 6)

I don’t know how the owner could justify the price of the parts, diagnostics, and labor, but as they say...”The customer is always right.”... Especially a paying customer!

Well, that’s all for this issue. Until I see you again, keep up the good work.

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![Figure 4: Sable’s Auto Lamp Relay Circuit Activated by GEM (Partial schematic, source AutoElectricPro)](image)

![Figure 5: GEM (L) Plugs into the Back of Fuse Box (CJB)](image)

![Figure 6: The Overheated Auto Lamp Relay on the Circuit Board of the Fuse Box (CJB)](image)
DISCOUNTED AIR TRAVEL TO BIGR/REMaTecUSA

Amsterdam RAI and APRA, the organizers of the autumn’s BigR/ReMaTecUSA exhibition, have established a partnership with the Skyteam Alliance, which offers reduced airfares to exhibitors and attendees to the show.

One of the world’s largest aviation alliances, Skyteam includes Delta, Air France, KLM Royal Dutch Airlines, China Southern and Korean Air. To and from Las Vegas McCarran International Airport, Delta and its subsidiary, Delta Connection serve over a dozen domestic destinations as well as major international hubs like Amsterdam, Paris, Shanghai and Seoul.

Terms and discounts may vary according to destination and time of booking. Exhibitors and attendees are recommended to check the website www.bigrrematecusa.com before making arrangements.

New show website: www.bigrrematecusa.com

The launch of a new website marks the start of APRA’s and Amsterdam RAI’s marketing campaign for the new BigR/ReMaTecUSA show in November. The website will be continually updated with news, developments and other information useful to exhibitors as well as visitors. “It’s important to us that we supply continuous information about all aspects of the show. APRA and Amsterdam RAI are embarking on a major new venture and there will be lots to tell along the way” said Exhibition Manager, Niels Klarenbeek. “Be sure to visit www.bigrrematecusa.com”

DUTCH ENGINE REMANUFACTURERS JOIN TOGETHER FOR VEGAS REMAN TOUR

Seven months before the opening of the inaugural BigR/ReMaTecUSA exhibition in Las Vegas (November 1-3 at the Rio Hotel and Convention Centre), the first major contingent of remanufacturers have announced their presence. The group comprises some 30 independent rebuilders from the Netherlands who will travel to the US under the auspices of BOVAG, the trade association for the Dutch motor industry. BOVAG’s activities include an active section of rebuilders and remanufacturers in The Netherlands.

“Every few years we organize a tour to a destination relevant to engine rebuilders for our members,” explains Jean Paul Borsten, president of BOVAG’s reman section. “The participants are a highly skilled group of specialists with in-depth knowledge of automotive, industrial and heavy duty engines. In view of the new development with BigR/ReMaTecUSA we decided that we ought to be present at this important event which we expect will enable us to establish new contacts with leading parts, core and equipment suppliers. We also plan to visit some of the large engine rebuild workshops in the Las Vegas area.”

Exhibitors interested in an meeting the Dutch group may contact jpborsten@enginedesk.com

NEW FACES AT THE BIG R/REMaTec USA SHOW—BOOTH SPACE IS NEARLY SOLD OUT!

Some major, new players in the reman industry have already announced their participation in BigR/RematecUSA 2014. These include Springfield Remanufacturing Company (SRC), WABCO Reman Solutions and ERC from the US and Autoenterprises of the UK. Around 70 per cent of the exhibition floor space have been booked so far. The total exhibitor list can be found at www.bigrrematecusa.com

RESERVE YOUR BOOTH FOR BIG R/REMaTec USA BEFORE IT’S TOO LATE!

Go to APRA.ORG and click on “Reserve a booth.”

Or go to directly to this page: www.apra.org/Meetings/2014/Big%20R_ReMaTecUSA_application.pdf

Almost sold out!
### Partial List of Exhibitors:

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Challenges of Remanufacturing Electronic Control Modules

ProgRama, Inc. of Boca Raton, Florida is one of the largest remanufacturer of European automotive electronics in the US. Since 1992 the company has been continuously extending its product line and today the number of offered units exceeds 400 different modules.

During the past 22 years ProgRama has met and successfully tackled numerous challenges related to the remanufacturing industry. It was clear from the beginning that the success of the company would depend on the detailed knowledge of the ECMS (Electronic Control Modules). For this reason ProgRama has been building a special knowledge base about the common product related problems and their repair solutions. The gathered information makes it possible to remanufacture the ECMS to their OEM (Original Equipment Manufacturer) specification standards.

The knowledge base itself is just the cornerstone of the remanufacturing process. The next challenge is to be able to fully test ECMS on the bench without the rest of the car. This can be achieved by using specially combined analog-digital and CAN (Controller Area Network – a two wire communication that connects most of the control units in the car) testers that can simulate the exact environment the ECM would normally operate in. These testers are custom built and continuously being calibrated as the whole process depends on the results they provide. A good example can be seen on the following picture that shows an instrument cluster being tested by a proprietary CAN base tester.

The word ‘Remanufactured’ implies that the remanufacturing process’ raw material is the OEM product itself. Because of this fact, the remanufactured products can comply or in most cases exceed the original product specifications. The nature of products such as Climate Control, ABS, PSE Pumps, Relays, Instrument Clusters, Throttle Actuators and Engine Computers require that the core (the original used or defective component) has to be reliable enough to be rebuilt. There are specific guidelines that are pertaining to each product that would make it acceptable for remanufacturing.

Today the biggest challenge is to locate quality rebuildable cores on the market. These could come from individuals, salvage yards, core suppliers or as core returns from existing customers. Dealing with cores usually requires the company to build and maintain a so called core bank. This proves to be crucial in times when there is a core shortage. Customers are being encouraged to always send in their cores and they are being compensated by core refunds. This incentive is appreciated by the customers as well as the favorable price of the remanufactured units. It is interesting to note that today the core return rate is at 85%, while 10 years ago it was at 90%.

After the original factory warranty expires and the repairs are not covered by the dealers anymore, customers should consider buying remanufactured products. Unfortunately dealerships because of their strict policy and existing contracts don’t offer rebuild or remanufactured products to their customers, they have been allowed to sell only brand new ones. Only those who go to independent shops can enjoy the above mentioned benefits and for instance save $500+ on a standard ABS or climate control module.

If the component is programmed to the car such as Instrument Clusters or Engine Control Modules the best choice is to send the defective part for repair directly to the remanufacturing company. Since it already includes the whole car specific information (VIN, mileage other parameters), when it is received back then no further programming or coding is needed. This could easily save an additional $200+ for the customers.

It is well known that even the most careful diagnostic session can mislead the technician to an incorrect part and initiate a wrong unit to be exchanged or returned. From the independent shop’s point of view another advantage is that in general the new OEM electronic products are not returnable to the wholesale distributors but the remanufactured ones are.

To further ensure the quality of the remanufactured products, a standard practice is that the commonly failing electronic components would be proactively replaced. This prevents future failures and thus builds up confidence in customers. In some cases even original micro processor software problems could be corrected by add-on circuits. All remanufactured units go through a detailed and thorough testing and finally a quality inspection. Once they meet or exceed the OEM specifications, only then they are ready to be called’ Remanufactured’ and sent back to the customers.

The quality of the remanufactured products can be measured by the length of the warranty term they are coming with. ProgRama is confident in its remanufacturing process and offers an exceptional 3 years warranty on most of its products.

Last, but not least the final challenge that we all have to face with, is to protect our environment. At the heart of the remanufacturing process lies the opportunity to ‘recycle’ a component instead of throwing it out. By rebuilding and reusing more and more components we all can do our part to minimize the impact of the automotive industry on the environment.

If you have product related questions, suggestions or requests then please make the process better by contacting ProgRama Inc. at 1-855-734-2670 or visit us at www.programa.com. Our Address is: 3303 N Dixie Hwy, Boca Raton, Florida 33431.
X-RAY EVALUATION FOR REMAN OF ELECTRONIC MODULES

Robert German and Ryan Kapp

Electronic and Mechantronic remanufacturing can present numerous challenges when it comes to identifying the root cause of field failures. When developing a new reman program it is important to quickly identify the physical infrastructure and a general strategy of creating a “better than new” remanufactured component. The core sampling and evaluation phase of a new program is the most critical period for data collection. Time spent on preliminary analysis, planning, and material sourcing can greatly increase the likelihood of launching a successful program. Accurate estimates of labor time, mandatory replacement components, and process fixtures are developed from evaluating core. This data is required to create a business case and supporting cost models to ensure a successful remanufacturing program.

While data collection is important, it can also be time consuming and expensive. The cost can be minimized by employing a standard methodology for evaluating modules based on their general family of common features. Creating families is helpful because similar products often have similar failure modes based on their function, design, technology, or components. Often the failure modes can be attributed to poor process control during manufacturing or poor design features. By establishing a standard evaluation protocol an organization can gather the required information much more quickly.

An effective technology to expedite data collection is X-ray inspection. First, X-ray inspection allows you to review a module for weaknesses or failures before it has been disassembled or had the potting removed. Second, X-ray is the most effective way to inspect the connections on integrated circuits (IC) with ball grid array (BGA) solder connections. The connections to this type of chip package are underneath the chip and must be inspected with X-ray, unless you want to damage the IC. An excessive amount of time and money can be wasted trying to remanufacture weak or failure prone boards and advanced lab analysis techniques are the fastest way to avoid this pitfall.

One thing that can typically be seen from X-ray analysis is the presence of uneven solder joints. This can result from screen printing issues relating to improper maintenance of stencils. Figure 1 shows an x-ray of an IC that has less solder on some of the pads, which could result in weaker joints and long term durability issues. Solder balling can also be seen to the left of the IC. This could indicate that other process parameters were not in control when the module was manufactured. Therefore failures due to board cleanliness and weak solder joints could result in high core failure.

Figure 2 shows another good example of why X-ray analysis saves time. The X-ray image of the BGA solder connections show existing voids and cracks that could become failure points under vibration or load. Figure 3 is a digital image that shows the remains of a solder ball after the IC was pried off the board. The solder fractured at the weakest point and left a nice example of how voids can cause connection problems by shrinking the size of the conductive path. Figure 4 shows a cross section cut from the IC and board that illustrates how the connection is impacted by voids in the solder ball and how a separation can occur. While figures 3 and 4 were not created with X-ray analysis, they serve to confirm and document what was quickly identified using X-ray inspection equipment.

Successful remanufacturing programs should always have the goal of creating products that are as good as new or better than new. The specific examples illustrated here should call attention to failures and weaknesses that are difficult to detect with functional testing of an electronic or mechatronic unit. A rigorous requalification process involving vibration testing and thermal shock may identify these issues but that is not always guaranteed. If a board or module is full of weak connections you may actually do more damage attempting to extract it from a housing or remove conformal coating to attempt a repair. In these cases it may make more sense to view the core as an opportunity for harvesting valuable components to support other repairs.

Robert and Ryan will be presenters at the 2014 BIG R/ReMaTecUSA Show in November. Their presentation on “Reverse Engineering of Electronically Controlled Products” will expand on advanced analysis techniques for developing new remanufacturing programs.
been on a vehicle for a number of years, it is most likely that the core is not the latest part number and that there has been a number of revisions over the life of the vehicle application. The goal is to produce a product with the latest hardware and software revisions as to supply the customer with the best quality product. By identifying and sorting the core, we can establish at what change level the inventory of cores is yielding.

Remanufacturing has its limitations and must be cost effective to be an attractive alternative to manufacturing. Remanufacturing a $20 dollar module does not necessarily make sense considering the labor required to disassemble, repair, upgrade, reassemble, and test an electronic control module. At times, low volume production makes absolute sense coupled with backwards compatibility.

Concerns exist with understanding the useful life of components during the remanufacturing process of the electronics control module. During product validation electronic control modules are tested in excess of 10 million cycles. The question remains “how many cycles did the core experience during its life”? Unless a cycle counter is in place during the design of the module then there is no way of knowing the cycle count. So how are we to know if the component on the board has experienced a high cycle rate or a low cycle rate? It is impossible to know exactly, however, maintaining accurate statistical failure analysis data during “as received” or “in process” testing will allow for judgment factors as to which component should be replaced automatically and which component will sustain a longer life cycle. This type of failure analysis should occur during tri-temperature testing. These test temperatures are normally minus 40 degrees Celsius, plus 125 degrees Celsius and ambient temperature. This requirement assists with the finding of intermittent failures occurring in relative temperature variations throughout the four seasons or regions of the country. Limited or no information about the failed unit is provided, so there is no knowledge if the failure was only occurring in the morning or after warm-up of the engine. Hot testing is suggested first (plus 125 degrees Celsius) due to the fact that some units have been cleaned with water and this removes any remnants of moisture prior to connecting the tester.

Ideally the electronic control module should be designed for remanufacturing. Some corporations have embraced this strategy by implementing this thought process within the design phase or PIM process of their new product launches. At times it can be as simple as allowing access via screws for disassembly or as difficult as having to replace the housing every time the remanufacturing process is engaged. Currently many manufacturers are plastic injection molded around the PCB board allowing limited access or the use of flex boards is incorporated. Accessing the components on the PCB board is the primary objective and needs to be the thought process when incorporating remanufacturing strategy within the design process. By allowing the remanufacturing process to become part of the design process can allow for future control of the market share by the OEM thus allowing for continued profits throughout the life of the vehicle.

Example scenario: It’s hard to imagine someone paying $1800.00 for a module for a VW Jetta when the car is ten years old and only valued at $4000.00. At this point the $600.00 remanufactured product looks very appealing to the consumer and maintains the brand support of the vehicle prior to the purchase of a new vehicle. This also keeps the consumer from purchasing a used unit from a salvage yard which may or may not meet the emission requirements. This scenario is environmentally pleasing as the old product does not return to the landfill and is remanufactured for another vehicle and the correct emissions are maintained on a very old vehicle thus making the event “green” and environmentally friendly.

One of the most political challenges within the remanufacturing industry is that as engineers we are forced to confront the gray marketers and compete against their strategies. A strong argument and one that is unsettling is based on this example: An ABS Control Module removed from a 1998 vehicle (pick your manufacturer) and an ABS Control Module from a 1999 vehicle of the same manufacturer are at times comparable and often consolidated by part number in the gray marketer catalogs. The unit will look similar in appearance and actually by part number in the gray marketer catalogs. The 1998 & 1999 products. Although the unit appears the meet the criteria of fit, form, function, they do not understand the underlying responsibility of software application. The software in the 1998 product was designed at a different level and improved upon through 1999. What the consumer does not know (and this is an exaggerated example for description purposes) is that the software produced for the 1998 application was designed to stop on ice within 90 feet at 50 MPH and the 1999 vehicle with the updated software package with the original product has an improvement of stopping within 60 feet on ice at 50 MPH. The consumer now has an inferior product that meets fit, form, function, but does not realize until it is experiencing an ABS event that the vehicle will not stop in a sufficient time. Engineers, OEM’s, and NITSA must raise this awareness.

Remanufactured units when properly built to the original manufacturers specifications become improved units based on the fact that the product is being upgraded within the remanufacturing process for the latest hardware revisions and is receiving the latest software application. In addition the components not replaced have literally been cycled and experienced and are less inclined to failure. Typically remanufactured product warranty is half of what the product warranty was at new OEM introduction levels. Inherent OEM warranty problems are solved and corrected within the remanufactured unit. The fact that tri-temperature testing is utilized on every unit versus sampling during OE production adds to the level of confidence with the product.

There is no doubt that remanufacturing is a viable solution for servicing past model vehicles and affords itself the luxury of being “green” and environmentally friendly. This coupled with customer retention and profitability should put this solution at the top of any OEM’s long term planning strategy.

“REMANUFACTURING: THE SUSTAINABLE SERVICE SOLUTION” — JOE KRIPLI
Today the bond of partnering in the automotive industry is simply unbreakable. It would not matter how good and cheap your units might be, it is nearly impossible for you to sell products to many NAPA stores unless the unit doesn’t exist in their program or they are temporarily out. They are so intertwined with their supplier that buying outside of the program requires special procedures. Special procedures increase cost. Special procedures are difficult to teach to new employees.

So apply this theory and this history to our industry today. I would say we are headed that way, but in fact to a large extent we are already there. There are suppliers selling to end users they never used to sell too before. There are regional suppliers and W.D.’s who have said “I give up on the small rebuilder”. “It is too competitive and easier to sell to the end users directly.” My own company has been punished for it’s loyalty to the small rebuilder. In a geographic area where we represent a large OE manufacturer, and a territory we increased by ten fold over the previous distributor, we refused and continue to refuse to sell to end users. Our refusal to sell around the rebuilders made our OE friends decide they needed to set up a second distributor in town who would be glad to sell direct. So in the end my loyalty to the rebuilder has gotten me another competitor in town. Although we are a very large customer, that OE had no problem “crossing the line”. In fact all the OE manufacturers programs are based around the W.D. selling direct to the user. Their marketing materials are supplied to the W.D. with selling to the user in mind. They do not have the independent rebuilder as part of their plan. Other suppliers have decided they need to stop servicing small rebuilders because the cost is too high. So they discontinue their truck service. Lower cost and be able to sell at lower profit margins. Yet is lowering service the answer here? Is that a long term answer?

Some independent rebuilders have taken the stand that they will bid out all their purchases and lowest price wins. With many web based pricing programs rebuilders can shop 24-7. What kind of motivation does that provide to suppliers to win the service race? What motivation does it give the suppliers to spend considerable moneys on quality control? In the end, simply shopping for the cheapest deal is no more the answer as chopping service is to the supplier. If it was the answer you’d still see independent Auto Parts stores everywhere that we just really good shoppers. But you don’t.

Ask yourself how many truly independent Auto Parts stores do you know of? I mean truly independent, not waving anyone’s flag. Now ask yourself, how will the rebuilder avoid the “natural selection” process that the general auto parts industry went through? The general Auto Parts industry is likely 50-100 times larger than our specialized segment and they could not avoid it. Why would we think we can? It’s what capitalism does, folks. It eliminates unnecessary parties from the supply chain, ultimately lowering the cost of the goods to the end user. Many Auto Parts stores were eliminated because they became unnecessary in the chain. The key that allowed some to survive is that they became necessary. They survived because they joined 1 supplier and created a partnership with a unified goal. To capture market share while both parties profit. Supplier and store with a vested interest in each others success.

The small auto electric shop should be an important link in the rotating electrical marketplace. Notice I say it should be, and not that it will be. The success of the industry, in my humble opinion, depends on our ability to form these partnerships.

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APRA Global Connection June 2014 11
## Paradigm Change — (All) Automotive Components Will Change to Mechatronics

Fernand Weiland, FJW Consulting Cologne (Germany)

I cannot often enough repeat, that nearly all automotive mechanical, hydraulic and electrical components will sooner or later change to become:

- Electrically actuated and
- Electronically controlled and
- Part of a CAN bus (or other buses) car network

See the impact below:

For OEM and Tier one remanufacturers it will not be such a challenge because they have the technology in house. But for independent remanufacturers it will be one of their biggest challenges. A mechanical remanufacturer has to make big changes, educate his workforce and hire specialists, invest in new test equipment and in reverse engineering. Only the fittest will survive but it will also be a big opportunity for those who will embrace the new technologies.

### Electronics — Remanufacturing a Challenging but Growing Business in Europe

I will not try to cover all the electronics fitted to a car, because it is in the meantime an area which is so vast that this task would go beyond the scope of this article. The number of electronic modules on a car is as high as 30 for a standard vehicle and up to 60 for high priced vehicle. The proliferation (variety) is not only high by product lines but also by car models. For some components the volumes are too low to envisage remanufacturing them, at least at this juncture. However if we select the fast movers remanufacturing becomes an attractive business model.

But on the other side Remanufacturing of automotive electronics is a challenging business. Theoretically, only remanufacturers who have access to OE data can remanufacture these components but many independent specialists have been able to resolve this by reverse engineering. Investments for them are of course high and the same is true for the special test equipment they have to buy or design. Because economies of scale are important, the remanufacturers have most of the time decided to remanufacture the current models first.

For this report, I have selected what I believe are for remanufacturing the most attractive electronics:

Firstly, the electronic control units for:
- Engine management for petrol/gasoline fuel injection
- Engine management for Diesel fuel injection
- Chassis control for brakes and steering
- Automatic transmissions

Secondly, the electronic infotainment units for:
- GPS navigation
- Audio (DVD, Radio, etc.)
- Instrument clusters

To assess the European annual replacement volumes for all these electronic units, I have based my estimation on known failure rates for engine computers.

I believe that for electronic control units the total annual European aftermarket yearly replacement demand is approx. 2.5 million units, of which ca. 300,000 units are remanufactured every year. Remanufacturing represents only 12 % which is low but I believe that it is steadily growing though the challenge like complexity is a major barrier for remanufacturers.

For electronic infotainment units my best estimation is an annual European demand of ca. 2.4 million units. The share of remanufacturing units is ca. 400,000 or 17 % of the total demand.

For all the product lines together the total demand is 4.9 million units and the share of remanufacturing is 700,000 units or only 14 %. As a comparison, the remanufacturing share in the USA is much higher. I am told it is ca. 50%! The conclusion for Europe is that remanufacturing has significant room for growing but it is difficult to forecast the future, since the products are complex and not all companies are keen to develop it!

These complex electronic products will be for independent remanufacturers who do not have access to the original technology and original data mean great investments in reverse engineering and test equipment. However, the challenge can be turned into an opportunity when remanufacturers finally acquired the know-how and can beat their competitors who have not embraced the change. In Europe we can observe that many new startups are created because the cost for a new unit is very high. They service at least regionally the garages and consumer looking for an economic alternative.

### Mechatronic & Electronic Impact on Components:

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**File:** Global Connection mechatronics 2014

**Words of Wisdom**

“As a child my family’s menu consisted of two choices: take it or leave it.”

— Buddy Hackett

www.remantoolbox.com
Delphi Product & Service Solutions announces new training course to help technicians repair ABS, stability control and traction control systems

DelphiAutoParts announces new training course to help technicians repair ABS, stability control and traction control systems

COURSE NAME:
Anti-lock Brake, Stability Control and Traction Control Systems

COURSE SKILL LEVEL:
Intermediate to Advanced

AUDIENCE:
All automotive aftermarket technicians

PREREQUISITES:
A basic understanding of braking systems

DURATION:
Four Hours

COURSE DESCRIPTION:
This course from Delphi is designed to help technicians become more familiar with Anti-lock Brake (ABS), Electronic Stability Control (ESC) and Traction Control Systems (TCS). Topics covered will include the components and operation of anti-lock brake, stability and traction control systems, which are essential for understanding more complicated braking and chassis control systems.

A better understanding of how these systems operate will enable technicians to become more efficient in system diagnostics and repair. Course discussion will include some of the more complex systems such as hybrid brake-by-wire, torque management and total system integration including CAN communications, which is necessary so information can be shared between chassis and powertrain controllers.

The intent of this course is to increase a technician’s ability to diagnose brake system concerns by:

- Increasing their knowledge of the anti-lock brake system components and operation.
- Increasing their knowledge of the traction control system components and operation.
- Increasing their knowledge of the electronic stability control system components and operation.
- Understanding the differences between anti-lock brake hydraulic channel systems and how they are used.
- Discussing the correct methods for performing anti-lock brake diagnostics.
- Discussing the correct methods for performing traction control system diagnostics.
- Discussing common electronic stability control problems.

After completing this course, technicians will be able to:

- Better understand the operation of an anti-lock brake system.
- Better understand the operation of a traction control system.
- Better understand the operation of a wheel speed sensor and the correct methods for performing diagnostics.
- Perform a brake bleeding process on vehicles equipped with anti-lock brakes.
- Better understand the operation of a hybrid brake-by-wire system.
- Better understand the operation of an electronic stability control system.
- Better understand the operation of yaw, lateral acceleration and steering angle sensors.
- Perform control sensor reset procedures.
- Better understand common customer perceptions regarding the brake, ABS, TCS and ESC systems.
- Perform brake service procedures for hybrid vehicles.

Learn more about Delphi at delphiautoparts.com or call 877-550-TECH (8324).
Confused about Health Insurance Rules in 2014?

There are different rules for individual/family health insurance policies and small group business health insurance policies in 2014. As the health insurance affinity partner for members of APRA, we would like to provide members with a clarification.

Individual/Family Health Insurance Policies

Health insurance policies were available during the annual open enrollment periods which ended on March 31st. However, beginning April 1st through December 31st, a special open enrollment period begins which allows members who experience a qualifying event to enroll in a new health insurance plan or make changes to an existing one. Members will have up to 60 days from the date of the qualifying event to apply for coverage.

Here are some of the reasons you may qualify for a special enrollment:

- Termination of employment
- Employer no longer offers health insurance
- Exhaustion of COBRA benefits
- Move to a different state
- Divorce/Legal Separation

Please note that if you missed the open enrollment and don’t qualify for a special enrollment, you can still stay insured by purchasing temporary or short term coverage.

Small Business Health insurance Policies

There are no open enrollment periods for small businesses with two or more employees. In 2014, small businesses with fewer than 25 full time employees making an average of less than $50,000 per year can qualify for a small business health care tax credit. The tax credit is worth up to 50% of the employer’s contribution towards the employee’s premium cost.

An example of how the tax credit works is that if you have 5 employees with wages of $150,000 total or $30,000 per employee, the employer is eligible for a 50% premium tax credit. Therefore, if the monthly small group premium is $2,500 and the employer contributes 50% or $1,250, the employer is eligible for a premium tax credit of $625 per month or $7,500 per year.

Any APRA member wanting more information on the special enrollment period for individuals/families or the small business health care tax credit should call Mass Marketing Insurance Consultants, Inc. at 1-800-349-1039 or e-mail to mmic@mmicinsurance.com.

DELPHI PRODUCT & SERVICE SOLUTIONS ANNOUNCES 20 NEW MASS AIR FLOW SENSORS COVERING 10.2 MILLION VEHICLES

Delphi Product & Service Solutions announces 20 new Mass Airflow Sensors to its engine management portfolio covering more than 10.2 million vehicles built from 1990 to 2013. Applications cover: Audi, BMW, Chevrolet, Hyundai, Kia, Lexus, Mazda, Nissan and Toyota. Part numbers include: AF10159, AF10162, AF10164, AF10168, AF10176, AF10184, AF10185, AF10205, AF10206, AF10207, AF10208, AF10210, AF10211, AF10212, AF10213, AF10215, AF10216, AF10217, AF10219 and AF10220.

Please visit go.delphi.com for specific part information. Inventory is available dependent on part number to end of Q2 2014.

What MAF Sensors Do

MAF sensors measure intake airflow and send this information to the ECU. When the ECU receives the information from the MAF sensor and oxygen sensors, it makes adjustments to the amount of fuel being injected into the engine to compensate for excess air or excess fuel.

When a Delphi MAF sensor is used in combination with Delphi oxygen sensors, the engine’s air/fuel ratio can be controlled much more accurately. All of these functions ensure accurate air/fuel ratio for optimal engine performance in any driving condition.

Why Sensors Fail

Contamination is a key reason why MAF sensors fail and require replacement. As air, dirt and other debris get into the sensor, the parts become contaminated and result in failure. Drivers often notice sluggish performance or a more frequent need to refuel.

THREE REASONS TO CHOOSE DELPHI’S MASS AIR FLOW SENSOR LINE:

1. All-New Products Go Through Stringent OE Testing

Unlike offerings from many competitors, Delphi MAF sensors are brand-new, never remanufactured. All parts are tested and calibrated to OE standards using highly accurate OE equipment. By testing to OE specifications, Delphi ensures that the
sensors provide accurate readings and airflow output, which helps to reduce comebacks.

2. No Flow Tubes Mean Less Storage Space and a Greener Quicker Repair

Delphi’s direct sensor solution design allows technicians to focus on the part that needs to be replaced. 98% of the time it is the sensing electronics in the probe that fail. By eliminating the need to replace the plastic flow tube, Delphi provides a greener repair solution.

3. In Most Cases Clam Shell Packaging Protects the Product

Shops receive Delphi Mass Airflow sensors in a plastic clamshell, which helps protect the sensing elements from damage.

Learn more about Delphi at delphiautoparts.com.

Delphi Product — continued from page 14

We at CARDONE expect significant growth as we continue to expand our coverage of existing product applications, as well as introduce more products previously only available through the O.E. dealer network. For example, we have planned a major expansion of our Electronic Throttle Body program during 2014.

Powertrain and engine management systems continue to evolve and become more sophisticated in order to meet federally mandated policies and improve overall driver experience. These management systems communicate with electronic sensors, modules and other systems throughout the vehicle such as steering and braking. Because of this, electronic content within today’s vehicles has reached approximately 50% and will continue to grow.

The growing percentage of electronic components in today’s vehicles combined with a growing vehicle population, new registrations, and increased average vehicle age translates into a tremendous opportunity for remanufactured products. As jobbers and service dealers become more knowledgeable of these higher tech products, and remanufacturers continue to make these products available to the aftermarket, reliance on the O.E. dealership will be diminished.

In addition to its extensive line of remanufactured electronics, CARDONE offers many “mechatronic” replacement parts, where electronics are incorporated into traditionally mechanical parts.

A Bright Future — continued from page 1

— Vince Lombardi

“ The only place success comes before work is in the dictionary. ”

INTERNATIONAL AUTOMOTIVE CORE SUPPLIER

ECMS!

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ALL MAKES & MODELS

WARRANTIES AVAILABLE

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Last month I wrote about the importance of using social media and other tools to promote your business. This month I’d like to focus on one tool in particular that can have an impact on your business and can be had for free. Facebook is the most widely used of the social media sites and has over one billion users worldwide. Facebook is on three of every four smartphones, and more than half of people on Facebook visit every day. So if you want to be successful, fish where the fish are.

Simply being on Facebook may not send the masses to your door but it does build brand awareness and remind people that you are there. If you’re in a niche market, many groups and businesses exist on Facebook that you can tap to spread the word about your operation.

To get started, decide if this is something you want to do yourself or have someone do for you. It is not difficult and pretty much anyone can do it. If you’re not inclined to do it personally there are a lot of folks out there like myself that will do it for you. There are a lot of sources available to coach you that you can find on Google, YouTube, etc. Facebook’s own site has a lot of information to help you.

The first thing to know is that before you can create a page for your business, you need to have a personal account which you likely do. If not, go to Facebook.com and create one as yourself. Add as much information about yourself as you’d like to share and then find your friends, family and associates and “Friend” them. This is important as they will help you get noticed once you establish your business page.

To create a page for your business, click on “Pages” on the left side of the screen and then click on “Create Page”. Add as much information as you can about your business including hours of operation, address, phone number, etc. Upload a Timeline Image which works best at 851 x 315 pixels. Also upload a Profile Icon which is 160 x 160 pixels. If you use some other size Facebook will resize it to fit and you may not get the desired result. Don’t be afraid to try it — you can’t hurt anything and if you don’t like the way it looks you can upload another image.

Next you’ll want to add some content. Anything you can add to tell people what your business is about will be helpful. A good way to get some ideas is to look at other business pages and see what they do. This is a great place to post images of interesting things you work on, particularly things you may not be well known for.

Once you get 25 people to “Like” you, you can get a personalized link that people can use to find you. Ours for example is www.facebook/youtechgroup. If you have a web page you can use this link to allow people on your website to click through to your Facebook page.

Now that you are established on Facebook there are a lot of steps you can take to target customers and run ads. We’ll discuss that in a future article.

Dennis Jacinto is an APRA Board Member and former Chairman. Formerly the owner of Lester Catalog he now heads YouTech Group, an internet marketing company. Dennis can be reached at dennis@youtechgroup.com or by phone at (530) 635-0495.
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