WINTER 2010

Equipment Manager

Official Publication: AEMP

Fleet Strategies For a Down Economy

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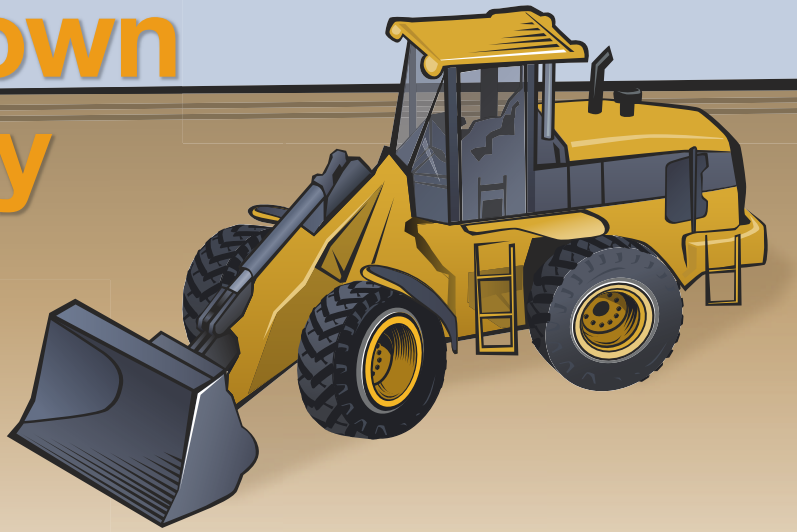

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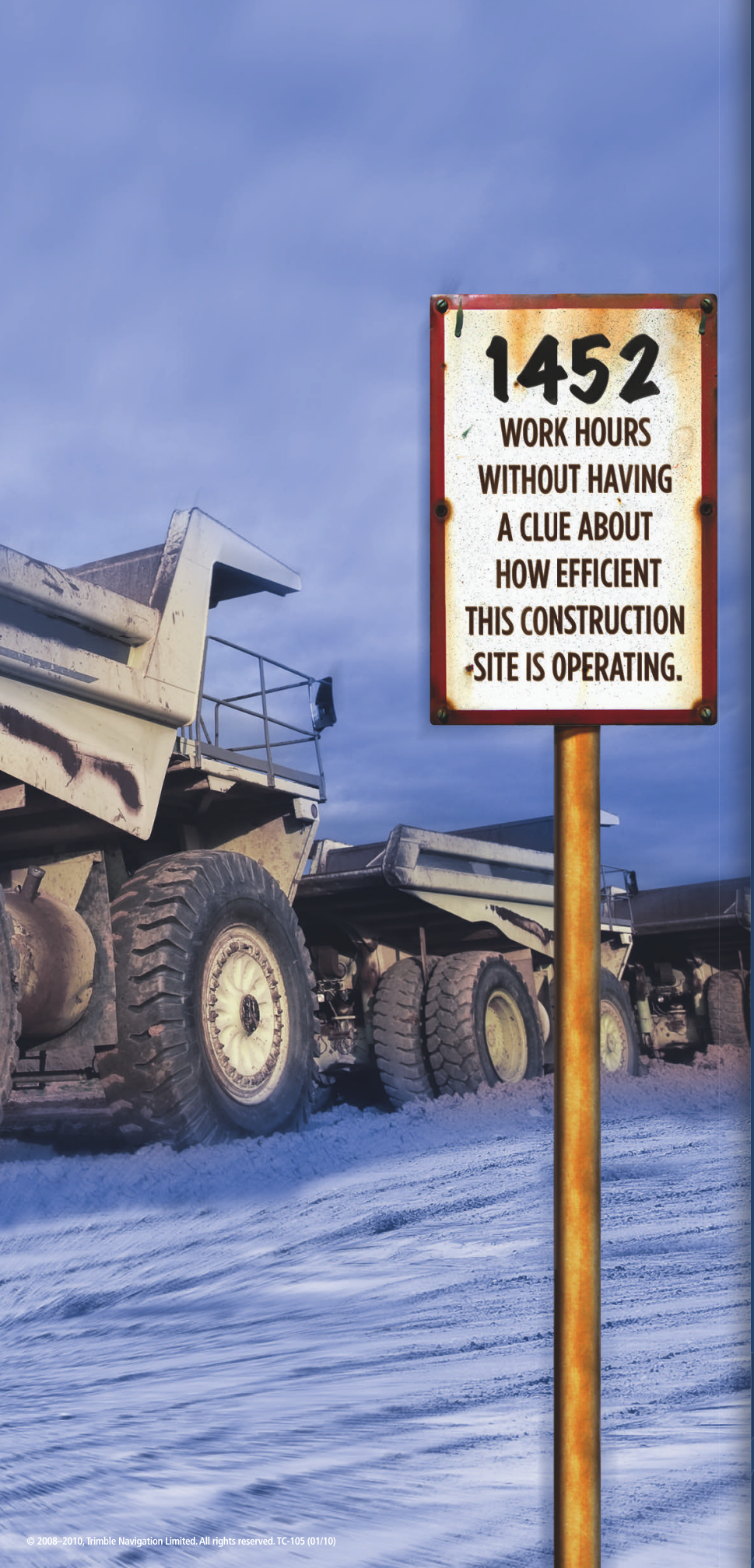

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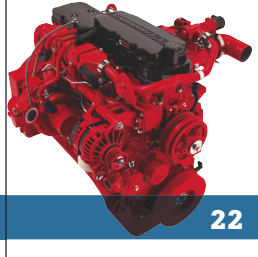

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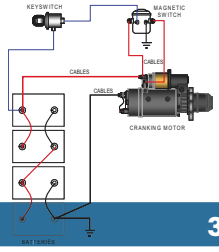

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Three Common Threads

By Mike Bates, CEM, 2009-2010 AEMP National President

I don't mind claiming that AEMP equipment managers are the best of the best. Perhaps, as AEMP National President, I am biased. Nonetheless, it really is no surprise to me that many AEMP member fleets are thriving, even in this bad economy. We have some members buying machines to keep up with the demand they're seeing. And wherever demand has softened, our members are fearlessly reviewing their business models. But why are some fleet managers buying machines and investing in the future when others are hunkering down, or worse yet, closing their doors?

Over this past year, I've observed many successful companies and fleets that seem to have three things in common.

They have the right connections. AEMP recognizes that access to the right connections is more important than ever in this tough economy. Knowing that a team of 800-plus industry professionals is on your side can take you far; and in times like these, that is critical to success. If you want to be successful in this market, you need to make sure you have the right connections and people on your side. Now is not the time to bury your head in the sand.

AEMP realizes that some of our own members have been laid off. But be assured you have a group of industry professionals on your side. We encourage struggling members to give headquarters a call and notify them of their situation. If you lose your job, AEMP will defer your renewal dues and keep you as a member of the association until you get back on your feet. We will keep our eyes open for any job openings and help you access the AEMP member job bank. Since education gives an edge when it comes to applying for jobs, we offer a limited number of Equipment Manager Scholarships in which qualifying individuals can receive discounted or complimentary registration to an AEMP conference.

They have an inherent understanding of the Equipment Triangle. As I mentioned above, connections are important in times like these. It is important for end-users to see manufacturers and distributors as partners. The AEMP Equipment Triangle is a good way to look at it: as OEMs and distributors shift their business models from sales to service, they are providing end-users with new tools to survive: service on existing equipment, education on emissions issues, fleet mix, and much more. All sides of the triangle must connect or the whole thing will fall apart. AEMP provides an ideal forum for all sides of the triangle to connect.

AEMP has taken this time to strengthen some of our relationships as well. Sister organizations such as the Association of Equipment Manufacturers and Associated Equipment Distributors give us new ideas and help us provide you with the critical tools you need.

They stay educated, innovative, and invest in the future and the latest technology. Competition is difficult when you are running equipment and technology that was developed decades ago. In today's high-stakes economy, you need high-quality equipment and technology that lets you handle anything you're dealt. If your company is not utilizing the technology available today, you can be assured your competition will be.

Some companies are taking this time to make changes that position them for the inevitable economic upswing. Weaker competition is being weeded out; equipment is available and affordable, and it's an employers' market. Equipment managers are being sent to AEMP meetings to take advantage of our educational offerings. Successful companies are taking this time to invest in the future. There has never been a better time to get the tools you need to start preparation for the economic turnaround.

If you'd like to know more about how AEMP has helped give equipment managers the tools they need to see their way through the recession, please give headquarters a call. AEMP is happy to share our successes and help you grow your company through networking, education, and keeping up to date with the latest technology.

AEMP Telematics Data Standard Update

By Pat Crail, CEM, John R. Jurgensen Co./AEMP Technology Committee Chair

AEMP's Telematics Data Standard is essentially complete, pending ratification by the participating manufacturers and telematics providers. The AEMP Technology Committee anticipates a January 2010 release of the standard document, with a development kit to follow shortly thereafter. Volunteer developers from McFadyen & Associates, Caterpillar, John Deere Construction & Forestry, Volvo Construction Equipment, Komatsu Americas, and the Caterpillar/Trimble joint venture, Virtual Site Solutions, anticipate an Oct. 1, 2010, launch date for support of the data transfer standard.

Over the past year, this group of volunteers has worked as the standards subcommittee to develop a standard format for the transfer of telematics data from the providers' servers to end-users. The standard was developed to facilitate programmatic retrieval of critical machine data for import into the end-user's database in order to simplify telematics implementation in a mixed-fleet environment. The standard provides basic machine data, such as cumulative operating hours, cumulative miles traveled (for vehicles), cumulative fuel consumed (where supported), and current location in a common xml document.

The provision of this basic information in a common format allows end-users to develop one API to parse the data and import it into their databases for use by the fleet-management application, allowing telematics data to feed the existing reports that equipment managers use to manage their fleets. The same API can be used to retrieve the data from each OEM (using unique authentication credentials and server information for each), greatly reducing implementation expense.

The standard was developed to facilitate programmatic retrieval of critical machine data for import into the end-user's database in order to simplify telematics implementation in a mixed-fleet environment.

This standard is intended to complement existing telematics web portals, rather than replace them. The data provided by the standard will allow users to automate once- or twice-daily updates to their fleet-level reports, and the data from each manufacturer will coexist with that from other providers and legacy machines whose data is still being entered manually. The telematics providers' web portals will still provide the more detailed information required for deeper inquiries into a particular machine or group of machines.

AEMP thanks everyone who has contributed to this project. The cooperation among team members from various OEMs and telematics providers has been incredible. Although progress has been slow at times, and the Technology Committee has had to constantly revisit details to ensure that all parties could support the resultant standard, everyone stayed engaged and pushed forward. Everyone pulled together to develop a tool that will advance the industry as a whole, benefitting all three sides of the Equipment Triangle: manufacturer, distributor and end-user alike.

AEMP will develop educational materials and training sessions to help end-users implement the standard. Look for workshops and seminars at next fall's Asset Management Symposium, as well as webinars and the release of the development kit, which will act as a user's guide. More information, including blog updates to which you can subscribe via an RSS feed, can be found at www.telematicstandard.org. Although the site is still under development, it will be continuously updated as we move forward. Additional information can be found at www.aemp.org.

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First BEAM Session Shines in Cincinnati

On Nov.12, 2009, *Construction Equipment* magazine and AEMP joined forces to host a close-to-home education session titled Grant Opportunities for Repower, Retrofit and Anti-Idle Technologies. The session, held in Cincinnati, is the first of what is hoped to be many regional sessions to come under the title of BEAM: Best Education for Asset Managers.

Individuals from grant agencies, manufacturers, vendors and construction companies attended the session to gain understanding of upcoming emissions standards, retrofit/repower technologies, and to find out how and whom to contact for information on government grants.

"The timing of the session was perfect," says Dick Brannigan, CEM. "With a deadline to submit RFPs by December 8 to the grant agencies through National Clean Diesel Funding Assistance Program, it was very well attended and provided essential information for the current round of grants."

John Deere and the Central Ohio dealership Nortrax Great Lakes sponsored the event, recognizing the importance of the topic to their customers. The event gave John Deere and Nortrax Great Lakes a chance to support AEMP educational programs and an opportunity to mingle with local customers and potential customers.

BEAM aims to take educational topics presented at the AEMP national meetings to local areas. Using local experts to make presentations, discuss situations, and participate on panels, BEAM is targeted to a specific audience. The local sessions will focus on contemporary or regional topics that are important to fleet asset managers.

Notes from the November 12 BEAM session are available for download on the AEMP website at www.aemp.org.

Attendees at the first BEAM event heard how government grants could be used in diesel emission-compliance strategies.

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The Certified Equipment Manager Institute

(CEMI) takes place twice annually in conjunction with the AEMP Annual Conference in March and the AEMP Fall Symposium in October. It consists of sixteen, one hour sessions relating to the sixteen equipment manager competencies covered extensively in the *Career Equipment Fleet Manager (CEFM)* manual.

Candidates for the Equipment Manager Specialist, Certified Equipment Manager, or the Certified Equipment Support Professional exams will find that the course is an excellent opportunity to study the content, ask questions of the professionals, and network with study groups prior to any of the three exams.

The Institute is open to all Conference registrants to attend any of the individual sessions but the Institute materials are only available to those that register specifically for the CEM Institute. ***Register for the March 14-16 CEMI and/or Certification Exams at the equipment manager learning source, aemp.org***

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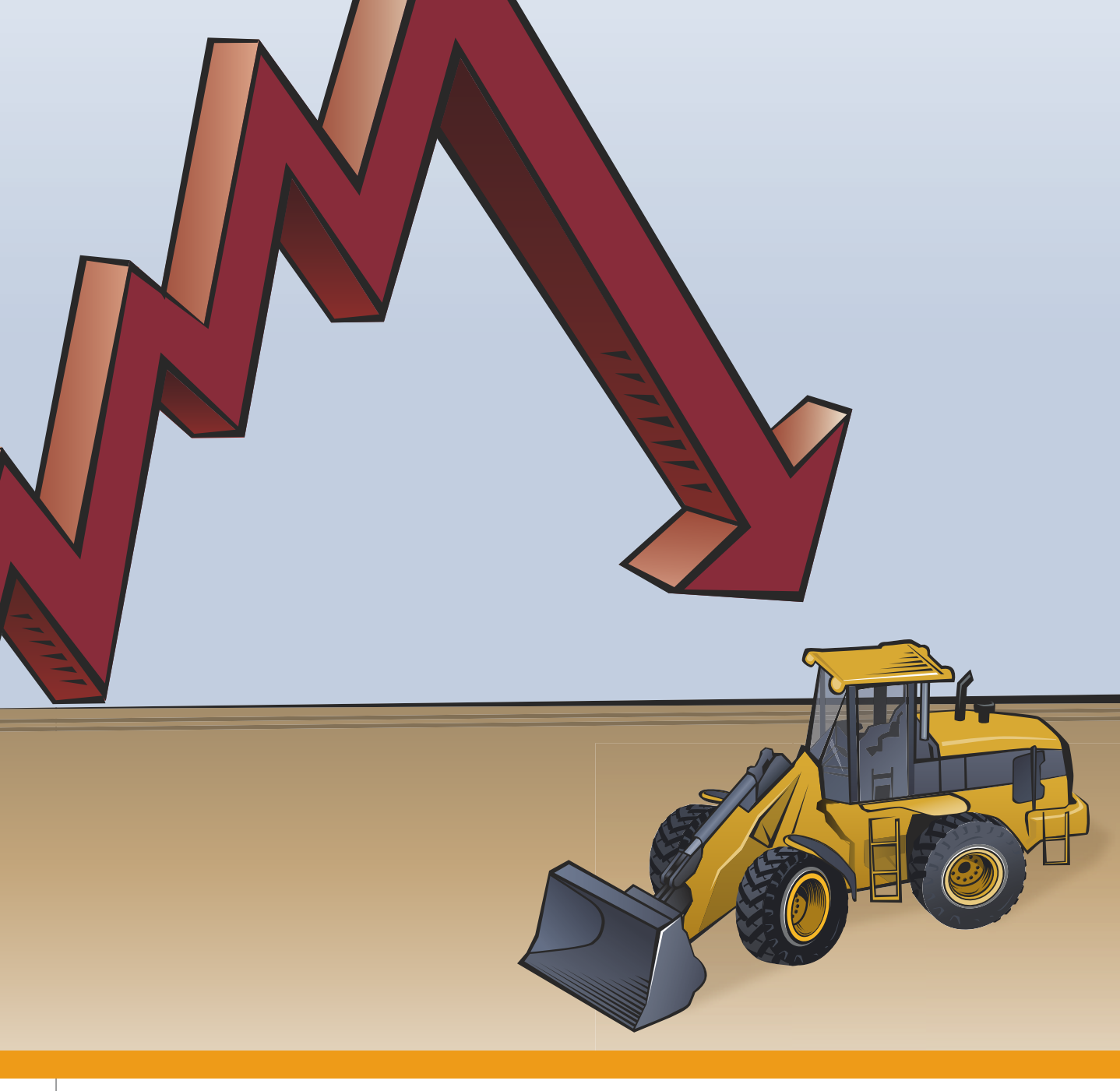

Fleet Strategies for a Down Economy

Equipment professionals must be able to make the right decisions and recommendations

By G.C. Skipper, Contributing Editor

As organizations pilot today's choppy economic waters, the bumpy ride has a jarring impact on the equipment-replacement plans of fleet professionals. As construction markets degenerate, public funding dries up, and credit markets retain a stranglehold on investment, construction equipment fleet managers are left with few, if any, projects in the pipeline. As a result, they are challenged with taking corrective measures to adjust to the downturn.

When the needs of equipment users change, it sets off a ripple effect that flows to each point of the Equipment Triangle, including equipment manufacturers and distributors as well. This was clearly documented in the results of a recent study conducted by Industrial Performance Group for the Associated Equipment Distributors (AED).

The study was based on an electronic survey of 86 fleet managers and equipment purchasers, 19 manufacturers, and 64 equipment distributors. Fleet managers confirmed that the ailing economy had caused their needs to change. Today, according to the survey, fleet managers have a greater focus on controlling costs, they are placing emphasis on equipment utilization, and they are not purchasing new equipment.

A total of 62 percent of end-users says the down economy had changed the way they shop for and purchase construction equipment and services. Fleet managers are more focused on ROI and total cost of ownership; are looking at how purchase decisions impact cash flow; are price shopping for the best deal; and are not purchasing new equipment.

OEMs reported that the present economic downturn has caused users to purchase less new equipment, operate old equipment longer, and do more price shopping when they are in the market. Distributors agreed that users are buying less new equipment, are price shopping, and running old equipment longer. Plus, distributors reported that users are opting for more rentals.

Adjusting to these changing needs of equipment users, 40 percent of OEMs are ramping up product support; offering extended hands-on training; providing faster, more flexible production; and helping customers diversify. Some 30 percent of distributors are adding customer support personnel, offering more services, expanding customer training, and developing maintenance programs.

Fleet managers' responses to the economic situation fall into two schools of thought. Like religion, both strategies seek the same destination. They just use different roads to get there.

Plan A

One strategy is to stick with the current equipment-replacement plan. The other approach is to make do with the equipment you have, put the replacement plan on hold, and use the capital elsewhere in the corporation to earn a better return on investment.

A proponent of the "stay the course" strategy is Dave Gorski, CEM, shop administrator for K-Five Construction. Gorski says a fleet manager doesn't have a crystal ball to know what is going to happen in the future. But the one thing he does have is a road map and that map is his scheduled equipment replacement plan.

> A fleet manager doesn't have a crystal ball. But the one thing he does have is a road map, and that map is his scheduled equipment-replacement plan.
>
> — Dave Gorski, CEM

"Like any other journey," Gorski says, "there may be detours, but as long as you know your destination it makes it easier to get around the detours.

"No one knows where the detours are," he says, "and that's where we are now. That equipment replacement plan may be a road map, but it is one that you have to massage and constantly monitor throughout the year. Since you can't pinpoint everything, you have to look at the aggregate of the fleet, for example, 600 pieces of equipment. In our case, we are going to do what we always do with our equipment replacement plan. We are going to execute it like we do each year by sitting down and evaluating everything we have."

For example, Gorski might have "X" pieces of equipment coming up for replacement this year.

"When we buy equipment, I set it up based on its category, then a

projected number of years and hours of service in the fleet," he says. "If a piece of equipment purchased in 1999 was set up on a 10-year useful life and a projected number of hours, that piece would be part of discussions this year as to where it stands in the fleet. Did it attain sufficient hours in the projected number of years and where do the O&O cost come in?"

K-Five "runs a very, very lean fleet," Gorski says. "We have enough equipment to get us through July and August. After that, we know we have to rent equipment. That's the way we are set up."

Other companies prefer keeping equipment in the yard for spare parts or keeping spare equipment to avoid rentals. But Gorski says the problem with that is "when you do go to start it, you have to spend $3,000 just to get it going. Renting, on the other hand, might cost you $4,000 — plus your operators get to run the 'latest and greatest' equipment that is out there."

K-Five relies heavily on concrete and asphalt paving equipment, machines that cannot be readily rented. Everything else, Gorski says, can be rented.

Perhaps Gorski's strongest argument for sticking with the plan has to do with emissions regulations. "If you look at projects around the Chicago area — a tollway project or new runways at O'Hare International Airport — all these jobs require equipment with Tier 3 engines. If somebody doesn't stick to their equipment-replacement plan and hangs on to older machines, where are they going to be when jobs come along next year? How are they going to be able to bid on jobs?"

Gorski says K-Five's production will fall short by about a month, giving the company a "decent year." Beyond that, "there is nothing ringing any bells," he says.

"By looking at our equipment-replacement plan, we see an opportunity in evaluating next year. For instance, we may be doing a lot of asphalt work, but hardly any excavating work. There are no 500,000-square-foot buildings being built right now, so we know business is going to be flat on the commercial side."

If that is the situation and, for instance, he has four motor graders that have zero to Tier 1 engines, he disposes of them. If he needs them unexpectedly, he either buys new ones or rents them. "A case like that gives us an opportunity to step back, look at where we are going and take that money to upgrade our core equipment, which is asphalt pavers and concrete equipment.

"We are not changing our equipment-replacement plan as far as capital budgeting is concerned. We are just changing where the money is being used," Gorski says.

One Dealer's Plan

Since the success of the fleet manager, OEM and distributor is dependent on each other, distributors can play an important role in helping equipment users survive the economic storm, says Diane Benck, vice president and general operations manager for West Side Tractor Sales, a John Deere dealer in Naperville, IL.

Benck says some of her largest customers continue with their equipment-replacement plans without hesitation. But others have completely stopped buying equipment.

"It depends on what their work load is and whether or not they are in highway construction where stimulus funds are available," she says. "Those who are in housing or subdivision development have completely stopped equipment purchases."

In times like these, it is the distributor's task to devise individualized plans for customers to see them through tough times. "There are no set rules as to what should happen right now," Benck says. "We truly are in uncharted waters given the fact that some markets have collapsed entirely."

The distributor, for instance, can help educate fleet managers on the emissions situation. "Fleet managers can't say, 'I'm not updating my fleet because business is bad,'" she says. "That is a dangerous philosophy right now."

Benck has also helped customers with consignment sales. "We take the machine, advertise it, and try to sell it for them, especially if they have too much of one type. We try to make sure they have a better fleet mix. Although there isn't much demand for equipment in a down economy, that is a service we offer."

When the market does turn around, distributors should have rental fleet ready to go. Rentals will be the next course of action for fleet managers before they start to purchase equipment, Benck says. "When that happens, the question becomes, 'Does the distributor or rental company have enough inventory?'"

Plan B

Pat Crail, CEM, emphasizes that one of the key elements of any replacement plan is flexibility.

"You have to be willing to review it periodically to make sure it is still appropriate for your organization, not just follow a replacement plan religiously," he says. "Circumstances change and there are no cookie-cutter strategies. I think the term 'best practice' sometimes is abused. Unfortunately, there are some fleet managers who think you should follow best practices no matter what."

Extremely low business cycles, such as the one we are in now, could well warrant another approach, he says. "The capital that you would usually invest in equipment you no longer need, might be invested in bonds, or used for acquisitions if competitors are on the ropes. What it all boils down to is that equipment is an asset that is expected to provide a return on investment for the corporation."

He gave this example:

Suppose a medium-sized asphalt and aggregate producer has a fleet of 100 wheel loaders. The replacement plan, based on your typical business cycle, assumes an average 2,000 hours per year on each machine. The ideal economic life is calculated at 20,000 hours, the point at which total hourly owning and operating are at a minimum. The plan calls to replace 10 machines per year, maintaining an average age of approximately 5.5 years for the fleet of loaders.

Now suppose business is off 30 percent for 2009. During the slack season, the organization has built up inventories and gotten ahead of plant maintenance while keeping the workforce employed. But now internal forecasts point to a slow 2010, and it's time to place equipment-replacement orders. Does the firm forge ahead with its replacement plan or delay replacement until the machines can work productively and at capacity?

"Do you invest $3.4 million of your firm's capital in 10 wheel loaders for the sake of maintaining fleet average age, or do you conserve capital and put it to work where it can earn a return?" Crail says. "The opportunity cost of that $3.4 million will vary depending on your organization and its alternative uses for that capital, but any positive return has to look attractive when compared with the alternative. Capital invested in idle machines earns a negative return, as opportunity cost and depreciation expense take their toll. Capital invested in underutilized machines fails to earn the organization's required rate of return and results in increased hourly ownership cost."

Granted, there is some risk involved in delaying replacement. Machines that should have been retired may break down while you try to squeeze that extra year out of them. You may have to replace some failed engines and transmissions that you would otherwise have avoided, increasing repair and maintenance cost. Reliability will likely suffer.

"However, if your forecasts are correct," Crail says, "you'll have plenty of excess machine capacity to pick up any slack caused by breakdowns, and the use of the additional capital may well justify any extra repair expense. There is also a risk that your forecasts are wrong, and that you'll end up with

Pros and Cons of Equipment Replacement

Stick with the plan

Pros:

- Fleet will comply with emissions regulations requiring Tier 3 and Tier 4 engines. Bids on future projects will require fleets to meet these standards.
- Continue to invest equipment capital in machines needed for core business.

Cons:

- Capital invested in idle machines shows no return on investment.
- Idle machines require additional money to get them going when jobs start coming in.

Defer Equipment Replacement

Pros:

- Frees up capital that can be invested elsewhere in the corporation for a positive return on investment.
- Because equipment replacement is only deferred, that capital can be used for new machines or for rentals when the economy does improve and jobs are again filling the pipeline.

Cons:

- Older equipment may not be acceptable on future bids because the engines don't meet required federal, state and county emissions regulations.
- Average fleet age declines.
- Repair and maintenance costs increase, requiring technicians and field support staff to work at capacity.

plenty of work. If that happens, you'll be asking these machines that should have been replaced to work a full year at capacity, and the downtime could be costly."

If there is a sudden rebound, the fleet manager can use the deferred capital to lease or rent.

"That's one of the keys," Crail says. "Everyone needs to understand that when you opt to defer equipment replacement, it is exactly that — a deferrment. It is the fleet manager's duty during strategy discussions to make sure the owners or CFOs understand you are not avoiding that replacement cost. You are merely postponing it."

Another risk of postponing equipment replacement is exchanging fixed costs — buying younger machines — for variable cost in terms of repair, maintenance and breakdowns. As the fleet ages, repair and maintenance costs go up; reliability will suffer; downtime will increase; and support resources, such as shop operations, technicians and field support, will be pushed to capacity.

> Everyone needs to understand that when you opt to defer equipment replacement, it is exactly that — a deferrment. You are merely postponing it.
>
> — Pat Crail, CEM

Despite the risks, deferrment gives the organization the option to use that capital for other strategic initiatives, including paying down debt or making acquisitions. "The use of that cash should not be taken lightly," Crail says.

No matter what equipment-replacement strategy is employed, Crail says, it is critical that the decision be part of a well thought out strategy that fits your organization's goals. "Any decision should take into account the risks and rewards. If you can't articulate your plan, whatever it is, you've probably made a knee-jerk decision, and would be better to walk away from it. EM

Pat Crail, CEM, fleet information manager at John R. Jurgensen Cos., checks equipment-replacement schedules. Crail says there are circumstances that allow fleet managers to defer equipment-replacement capital and use it for other company investments with a better ROI.

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Emissions Evolution

This year ushered in another round of Tier changes on certain engines, but we're not through yet

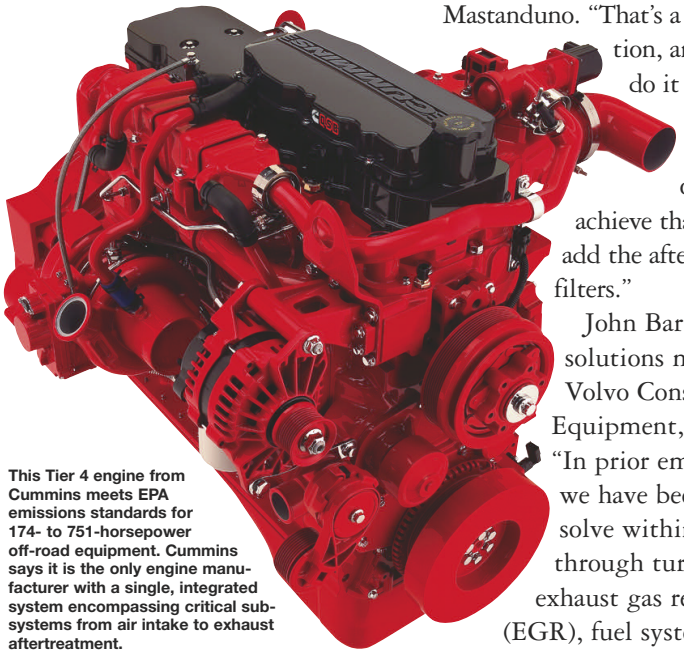
By G. C. Skipper, Contributing Editor

"Part of the problem in complying with future emissions standards is that there is so much we don't know," says Lorne Fleming, CEM, and chair of AEMP's emissions task force. "The old saying that 'the devil is in the details' is absolutely correct."

What is known is this. The next wave of new engines will reduce particulate matter (PM), and it will be followed by a second wave that targets N0x.

The "devil in the details" plays out this way, according to Joe Mastanduno, product marketing manager, engines and driveline, John Deere Construction and Forestry. Engines below 25 horsepower are already Tier 4. Existing engines between 25 and 75 horsepower are labeled interim Tier 4. The 75-horsepower engines currently used to power large skid steers and small compaction equipment, for instance, are Tier 3 and have the capability of reducing particulate matter from a 0.2 level to the 2010 requirement of 0.02 level.

In 2011, however, managers of off-road equipment will see changes. Machines 75 horsepower and above will arrive from the factory equipped with particulate-matter filters that help lower PM by 95 percent, says Mastanduno. "That's a huge reduction, and you can't do it with engine design alone," he says. "The only way to achieve that level is to add the aftertreatment filters."



This Tier 4 engine from Cummins meets EPA emissions standards for 174- to 751-horsepower off-road equipment. Cummins says it is the only engine manufacturer with a single, integrated system encompassing critical subsystems from air intake to exhaust aftertreatment.

John Bartz, emissions solutions manager at Volvo Construction Equipment, concurs. "In prior emissions years, we have been able to solve within the cylinder through turbo charging, exhaust gas recirculation (EGR), fuel system optimization, and by working on the combustion of the fuel. The huge PM reduction will be achieved by the implementation of particulate traps."

In 2011, engines of 175 or greater horsepower equipped with PM filters will be classified as interim Tier 4. They will be classified as final Tier 4 (after further reductions in both PM and NOx) in 2014. By 2013 the 25- to 75-horsepower machines will become final Tier 4, and by 2015 machines between 75 and 174 horsepower will go to final Tier 4.

"For five years we have different horsepower brackets that are phasing in," Mastanduno says. "By 2013 and 2015, the final Tier 4 engines on these machines must reduce NOx substantially. We have to find a way of doing this, just like the on-highway vehicles are doing beginning in 2010."

Another 2011 change, Bartz says, is that Tier 4 engines will be required for larger equipment, 175 to 750 horsepower, as used in haulers and larger wheel loaders. He described these machines as, "the meat of most construction-equipment fleets."

The reason for tightening the noose on particulate matter, which is nothing but soot, is that PM aggravates respiratory illnesses,

contributes to lung cancer, and can cause heart disease, according to scientific studies. NOx, which is formed by high combustion temperature, contributes to acid rain and ground level ozone (smog), the studies say. It can also have a negative impact on air quality.

Ironically, high temperatures that destroy particulate matter also form NOx. Lowering the temperature reduces NOx but forms particulate matter. This creates the problem of balancing the combustion process to satisfy both PM and NOx. And if all this horsepower phase-in is not convoluted enough, reducing both PM and NOx has given rise to two main technologies. One method Mastanduno calls "massive exhaust gas recirculation (EGR)." The second technology is selective catalytic reduction (SCR).

The Pros and Cons of EGR and SCR

ADVANTAGES OF EGR:

- Slightly less costly than SCR at purchase
- No maintenance issues beyond the very occasional DPF cleaning
- Operators play no role in meeting EPA standards
- No significant hardware additions

DISADVANTAGES OF EGR:

- Likely negative impact on fuel economy
- Significant thermal issues

ADVANTAGES OF SCR

- Improved fuel economy
- Lower heat rejection

DISADVANTAGES OF SCR

- Added weight and cost of the SCR components
- Cost of DEF

(Information courtesy of Diesel Progress Magazine)

Muddying the stream is yet another emissions regulation, triggered by the California Air Resources Board, requiring engine manufacturers not only to reduce particulate matter and NOx on new engines, but also reduce greenhouse gases on equipment already in the field. EPA and CARB emissions standards are the same for new engines. Although 18 states are likely to adopt CARB emissions standards to reduce pollution from existing machines, Bartz says, "nobody has adopted that to my knowledge, because it can't be adopted without EPA approval."

The MaxxForce 11/13 International engines from Navistar for 2010 on-road application comply with 2010 emissions regulations with Advanced EGR, a high-pressure common rail system to provide electronic control and programmability capable of multiple injections per combustion event. Other key elements include proprietary combustion bowl design, advanced air management with dual turbochargers, and electronic calibration strategies to optimize fuel economy and performance.

The problem is that many regions, counties and even cities, such as New York, have emissions regulations that are unique to that jurisdiction, says Fleming, director of Grace Pacific's equipment division. For example, he says, "Our friends at the Oakland Port Authority just announced that if your equipment has a non-Tier engine, you're out of there. How many people are going to be able to comply with that? There are other Port Authorities that have done some modification of the same thing, Portland, for instance.

"The economic impact of such regulations can be seen in Oakland. It slipped from No. 4 in volume to No. 5, largely because people anticipated that this would happen."

Fleming says it is unclear what methodologies will be used to reduce engine exhaust components such as greenhouse gas emissions. "I don't think anybody really knows," he says.

Not only is the greenhouse gases reduction technology unclear, Fleming says, but there is something of a "cat fight" going on between Navistar's approach to reducing PM and NOx and that of other engine manufacturers in regards to the 2010 requirements for on-road engines. The majority of engine makers plan to meet the standards with a combination of EGR and SCR and using additional components such as particulate traps and engine regeneration, along with low ash oil and ultra low sulfur fuel.

Navistar will not use the EGR/SCR combination of technologies, says Tim Shick, director of sales and marketing for the company's engine group.

"All manufacturers since 2002, other than Caterpillar, have gone

with a cooled-EGR system to reduce emissions," Shick says. "For 2010, NOx requirements are going down from a current 2007 level of 1.2 grams per horsepower (for on-road equipment) to a 0.2 gram level. We at Navistar will continue to go on that EGR technology in 2010."

There are reasons why the company, which builds International trucks but no off-road equipment, is not going with the EGR/SCR combo, says Shick. First, International customers say they don't want to add any more emissions apparatus to their vehicles, such as SCR liquid urea systems, and second, they don't want operators to be involved with emissions controls beyond simply turning the key. SCR technology requires operators to regularly add liquid urea or diesel emissions fluid (DEF).

Shick says other engine makers adopted SCR for North America because they already had developed the technology for Europe. "We are an American company and we do not participate in the European marketplace," he says. "Other engine manufacturers had to turn to SCR to sell in the European market. We never did."

The technology debate going on between Navistar and other engine OEMs is over whether or not EGR alone can achieve necessary PM and NOx levels.

"Others say, all things being equal, that achieving those levels can't be done using only EGR," Shick says. "Other things will degenerate or worsen with increasing rates of EGR, they say."

The "you can't achieve" claims are easily refutable, he says, "because there is a direct relationship between the amount of exhaust gas you put into an engine and the amount of NOx it gives off in the combustion process. All EGR does is replace oxygen in the cylinder. You have less oxygen to produce NOx. That's not the challenge. The challenge is how to maintain fuel economy, oil and maintenance intervals and maintain power and drivability that customers are use to."

	Horsepower Groups							
Year	25-49	50-74	75-99	100-174	175-299	300-599	600-750	750+
1995	T0	T0	T0	T0	T0	T0	T0	T0
1996	T0	T0	T0	T0	T1	T1	T1	T0
1997	T0	T0	T0	T1	T1	T1	T1	T0
1998	T0	T1	T1	T1	T1	T1	T1	T0
1999	T1	T1	T1	T1	T1	T1	T1	T0
2000	T1	T1	T1	T1	T1	T1	T1	T1
2001	T1	T1	T1	T1	T1	T2	T1	T1
2002	T1	T1	T1	T1	T1	T2	T2	T1
2003	T1	T1	T1	T2	T2	T2	T2	T1
2004	T2	T2	T2	T2	T2	T2	T2	T1
2005	T2	T2	T2	T2	T2	T2	T2	T1
2006	T2	T2	T2	T2	T3	T3	T3	T2
2007	T2	T2	T2	T3	T3	T3	T3	T2
2008	T4I	T4I	T3	T3	T3	T3	T3	T2
2009	T4I	T4I	T3	T3	T3	T3	T3	T2
2010	T4I	T4I	T3	T3	T3	T3	T3	T2
2011	T4I	T4I	T3	T3	T4I	T4I	T4I	T4I
2012	T4I	T4I	T4I	T4I	T4I	T4I	T4I	T4I
2013	T4	T4	T4I	T4I	T4I	T4I	T4I	T4I
2014	T4	T4	T4I	T4I	T4	T4	T4	T4I
2015	T4	T4	T4	T4	T4	T4	T4	T4
2016	T4	T4	T4	T4	T4	T4	T4	T4
2017	T4	T4	T4	T4	T4	T4	T4	T4
2018	T4	T4	T4	T4	T4	T4	T4	T4
2019	T4	T4	T4	T4	T4	T4	T4	T4
2020	T4	T4	T4	T4	T4	T4	T4	T4

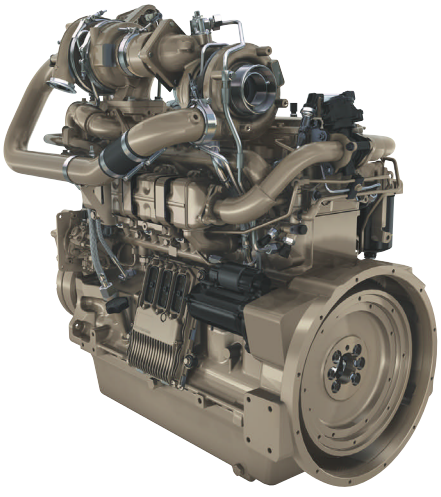
Off-road diesel emissions standards will be introduced in phases based on engine horsepower. This chart shows what has happened from 2005 through 2009 and what will happen from 2010 to 2017.

Shick says International trucks that Navistar will have on the road in 2010 will have all the same ratings as they do now; will drive, sound and maintain and use fuel "just like today's engines." On fuel economy, he says, the net impact will be zero, 1 or 2 percent above where they are today.

Navistar is meeting the 2010 standards with emissions credits. "If you look at the standard, which is 0.2, Navistar will still be at 0.5," says Deere's Mastanduno. "Eventually, those credits will run out. As Navistar will tell you, they are working hard to bring the emissions level down from 0.5 to 0.2, and that requires more research and development work and maybe some changes.

"So far, they haven't demonstrated that they are going to come out below the emissions level. It's kind of a gamble," he says.

Mastanduno said that using EGR only "is a way (for Navistar) to differentiate themselves and a way to say the operator doesn't have to worry about the second fluid. That's their marketing claim, but if



John Deere Power Systems Tier 4/Stage 111 B engines have ratings of 174 horsepower and above. The PowerTech Plus technology features 4-valve cylinder heads, cooled exhaust gas recirculation, full authority electronic engine controls, high-pressure fuel systems, and air-to-air aftercooling.

you look at the off-highway agriculture where SCR technology has been introduced, the claims there are completely opposite of what Navistar says."

These changes in emissions standards will impact asset managers several ways, according to Mastanduno. First, in 2011 when PM filters are added, they will experience higher operating costs, whether it be fuel that is used to help regenerate the filter or, in some cases, removing the filter every 3,000 to 4,500 hours to clean it.

"These are costs we haven't experienced before," he says. "Owning and operating costs will go up and, because the level of technology is much higher on the later-Tier engines, the price to buy the machines will go up."

Fleming worries about other headaches: additional training for technicians and operators; the resultant aggravation of finding and retaining qualified technicians; and the maintenance of the advanced-technology equipment itself.

"When it quits working, how much is it going to cost to get it going again?" he says. "As an example, we have a little portable screen for a piece of rock-processing equipment that has a computer on it. The computer runs the machine, engine, generator, safety shutdowns and starting procedure. Now I have to have a guy in the quarry who not only knows how that machine's mechanical process works, but also is able to work his way through a computer and complex system-programming issues."

And, he says, when the integrated control system "causes complete system failure, how much is it going to cost to get it running again? The board alone, along with the screen, is not serviceable. You have to replace the whole thing, and that is about $3,000."

But the biggest impact of the changes is that machine operators have to be made aware that the PM filter must be regenerated. "This is something the operator didn't have to do in the past," Mastanduno says. "You have to make sure the operator has enough training in the new technology and make sure regeneration is happening."

Despite the changes that asset managers will have to adjust to, he says, "SCR is a proven technology. If you look at the on-highway market, you will see that seven out of

Averaging, Banking and Trading

The Environmental Protection Agency's AB&T program is short for "averaging, banking and trading," and the voluntary program allows engine makers who reduce emissions below regulatory requirements in one model year to offset these reductions against emissions in a later model year.

Navistar will use the AB&T in 2010 to achieve full compliance with EPA and CARB emissions requirements, says Tim Shick, the company's Engine Group director of sales and marketing.

The AB&T program allows manufacturers to produce engines with lower than required emissions levels and produce them earlier. For instance, Shick says, an engine that meets emissions regulations for 2010 could be introduced in 2007. The engine manufacturer would be given credit for every engine sold at this lower level.

"The EPA keeps a tally of this information, counts them, and in 2010 we will be able to offset those engines with engines that are higher than the 2010 emissions level, but with the stipulation we can only use 80 percent of the credits we generate," Shick says.

Over time, the net is right on standard, he says.

"In 2010, Navistar will introduce its engines no higher than 0.5 grams, but can only use 80 percent of the credits we have earned up to 2010."

He explained that is what engine manufacturers are talking about when they say Navistar is going to use credits in 2010. "We were lower earlier and will be a little higher later, but because of the 20 percent discount we are always lower in total," he says.

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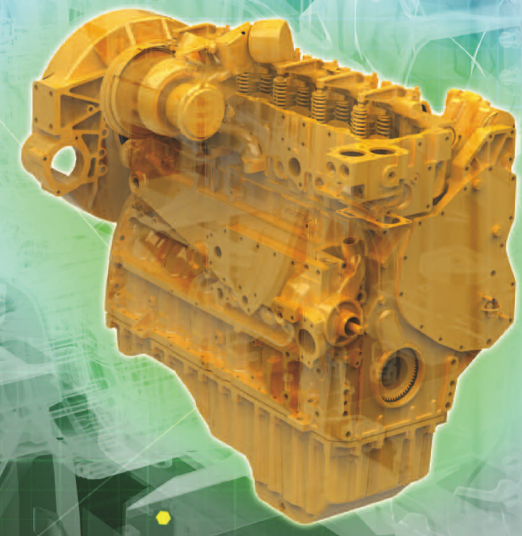

When inspecting an engine, the secret is in the smoke. Or, more specifically, the color of the exhaust. White smoke could mean coolant in the engine cylinder. Blue smoke indicates oil in the engine cylinder and possibly worn valve guides and piston rings. Continuous black and grey smoke points to improper air/fuel mixture and a good chance of worn injectors or fuel timing.

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eight manufacturers are going with SCR starting in January. For everybody, SCR is a safe technology."

Clint Schroer, Cummins, says the company had invested in "critical technologies" to meet the more stringent emissions levels, including combustion research, fuel systems, turbo charging, filtration, exhaust aftertreatment and control systems.

"All this technology becomes more and more significant," he says. "It means we can achieve the goal of maximizing customer value by providing the right technology all from within our on-road technology portfolio with every system integrated." He says the Cummins cooled-EGR subsystem and the Cummins particulate filter aftertreatment have proven their durability and reliability.

And it is in the culmination of all this technology that the Equipment Triangle can again prove itself, says Fleming.

"The vendor, customer and distributor all have a vested interest in each other's success. We are all in this together. And I believe that relationship is going to become increasingly important. I depend on distributors and OEMs to keep me updated on this emerging technology. If I can't find out why something is not working, then I don't know what repairs to make and even what parts to buy."

Although Fleming says he is no pessimist and believes the emissions evolution is going to be exciting, it's no time for "anybody to feel easy about the direction we are going to take."

"You will see increased regulations," he says. "You will see not only refining of regulations, but you are going to see new initiatives and efforts by more governmental entities. Industry input will be minimal, I believe. Even CARB isn't listening to anybody in the industry; they are listening to their academics."

Navistar's Shick says there's no single solution. "There isn't a single, magical technology. There are a variety of ways to meet these new regulations. Choices have to be made, and these choices have to do with what's best for each fleet's customers." EM


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Information Need Drives Data Flow

Work from the back forward to create reports that provide actionable information

By G. C. Skipper, Contributing Editor

You don't need a magic wand to turn data into useful information. The trick, though, is knowing how to go about it.

At John R. Jurgensen Cos., Pat Crail, CEM and fleet information manager, has succeeded in putting an end to the old lament, "data rich and information poor." He did it by flip-flopping where he starts the process.

Many fleet managers, he says, start out with the data, distill it, and then combine it with other data to create information. When you do this, however, you set off an avalanche of data barreling down from your accounting system, your machine systems, work-order systems, and other sources.

"These fleet managers then try to figure out what to do with all that data," Crail says. "This approach is getting harder and harder to do as we move into the telematics age." He is in a good position to know since he is on the AEMP technology task force working on telematics protocol. "The difficulty in starting with data is the sheer volume," he says. "It is incredible."

Pat Crail, CEM and fleet information manager, has succeeded in putting an end to the old lament, "data rich and information poor." He did it by flip-flopping where he starts the process.

A better approach, in Crail's opinion, is to start with the information end of the spectrum. "You will find you can get by with much less data and can focus on making the data you have as accurate as it can be," he says.

Consider what information you need, what information the users need, and who needs to see what within your company. Once these questions are answered, Crail says, work backward to determine what data fulfills the needs of the different users and what format works best for each user.

"Rather than trying to make use of all the data and all the cool things you can do with it, start with what it is you need to know, who needs to know it, and where you can go to get the data that will provide the needed information."

For example, an hour-meter reading from a piece of equipment in and of itself is only a meaningless number, he says. Various levels of management, however, have different needs and to each of them the number represents different information. A supervisor, whose primary job is to dispatch technicians, needs to know what machines are due for service, when they are due, and what service is to be performed.

"For him, you combine a couple of pieces of data and get that information to him," Crail says. "You show him the last time a machine was serviced at what hour-meter reading, the current hour-meter reading for each of the machines, and combine that with a preventive maintenance schedule that tells him when the machines are due and where the machines currently are located."

A middle manager, by comparison, may need the hour-meter reading in the context of major component life. How many hours are on the engine since the last rebuild? How many hours on the transmission since the last rebuild? This gives him a quick reference as to component age.

"When the middle manager looks at a machine to make a repair decision, he has some idea how old the components are and whether or not the machine is getting close to a rebuild," Crail says.

A fleet manager also needs the hour-meter readings, but he is more concerned with fleet average age of each equipment class and how that age is dispersed within a specific class, says Crail. "He's looking for what machine needs replacing and

what machines need repairing."

Crail says the format for the information depends on the user. For example, a supervisor responsible for scheduling PMs needs a report, whereas a fleet manager dealing with large groups of data needs a graphic representation that makes it easier to understand and display the information.

Other users might find it faster and more useful to pull information off a computer screen when it's needed.

In his company, Crail makes the decision on who needs what and in what format. His decision is based on a number of factors — for instance, regular discussions with the shop staff to determine if they are getting what they need.

"We talk about whether the format being used is a good one," he says. "Is the information relevant and is there any information they need that is not being provided?"

Other factors that might play into Crail's decision are management-driven topics, such as clearly conveying to workers that, "this is how we want to run our railroad."

Turning data into actionable information requires certain basics or standards if the technology is to be of any help in managing a fleet, he says.

"Answering this question is the backbone of the telematics standards the AEMP technology task force is working on now with OEMs," Crail says. "We are pulling together basic pieces of data that provide the bulk of the information a fleet needs to operate. They include the previously mentioned hour-meter or odometer readings; location of the vehicle based on GPS information or job numbers, depending on how the company is organized; fuel consumption, which is becoming more and more important as fuel costs rise; and cost information, such as owning and operating costs, plus all the subcategories that go under that."

In addition, fleet managers should have access to repair data from work-order systems, Crail says. "They need to know such things as proactive repairs (these are planned and implemented, such as major overhauls and maintenance) versus reactive repairs (work done on equipment that breaks down)."

But, says Crail, gathering the data is perhaps the biggest hurdle that must be overcome. "Any time a human being is involved in the process, you have the chance of human error," he says.

"Rather than trying to make use of all the data, start with what it is you need to know, who needs to know it, and where you can go to get the data that will provide the needed information."

At Jurgensen, all this has been more than just a better way to build a mouse trap. It has meant Crail can make faster and better management decisions.

Six or seven years ago, in anticipation of what they might need in the future, Crail and the management team put category codes into their work-order system. "For instance, a shop foreman would fill out a repair form that told us whether a repair was proactive or reactive. Another code we entered identified downtime, if any, associated with the repair. Did it break down on a shift where it was expected to run?

"We put these codes in place several years before we had the capability of using the information. What's important is to realize you are looking at historical data, and the sooner you put the codes in place, the sooner you start building a database. We got those up and running right away," he says.

Over the years the results have allowed the company to quantify the effects of a proactive/reactive ratio, says Crail. "It tells us how much money was spent, how much of the effort was proactive, how much was reactive, and it helped us quantify spending additional efforts on proactive maintenance, on downtime, and overall machine lifecycle costs."

One thing he discovered was that "the tail was wagging the dog," says Crail. "Most of our work was reactive and not enough proactive work was done as far as PMs were concerned. By having all that coding in place, we assigned one technician as a full-time PM inspector."

Once he identified the problem and started putting in more time on the proactive process, Crail saw a substantial drop in total maintenance cost fleet wide. During the first year alone downtime fell 20 percent. "The first year after the PM problem, the machines were breaking down less, and when they did, the breakdowns were less severe."

Crail has seen other positive results from using this approach to turning data into actionable information and he expects to see more.

"We view this as a continuous improvement cycle," he says. "It is never finished." EM

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How to Test a Starting System

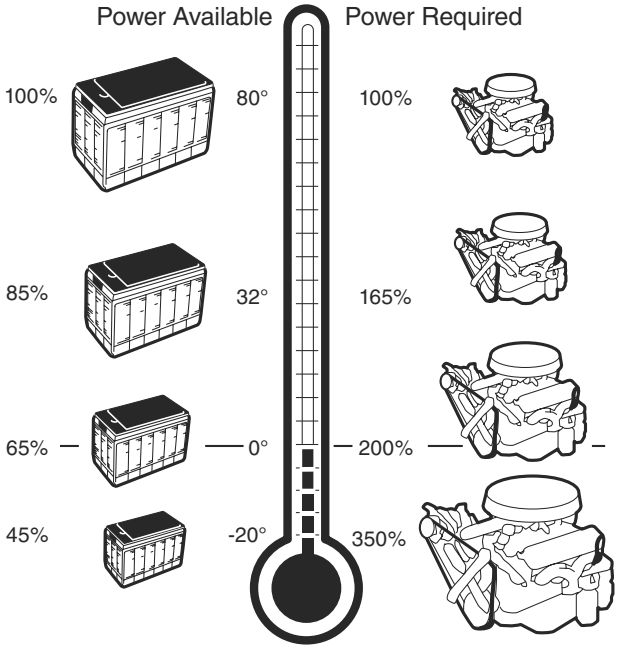
In order to take some complexity out of the task, follow these three steps — in the correct sequence

By Brad Purkey

A diagnosis of any electrical system, whether it is 12 or 24 volts, must include two key elements. First, you must test the complete circuit. Second, you must understand how that circuit works.

One of the most important circuits in the 24-volt electrical system in any vehicle or piece of construction equipment is the cranking circuit. It typically has the following components:

- **Battery pack.** Two 12-volt batteries connected in series to obtain the 24 volts.
- **Cranking motor.** A 24-volt unit that converts the electrical energy from the batteries to mechanical energy to crank the engine fast enough to achieve ignition.
- **Magnetic switch.** Normally mounted near the cranking motor, this device takes a low-current signal from the ignition key switch and closes large contacts in the magnetic switch that connect the cranking motor's "S"-terminal of the solenoid to battery voltage.
- **Ignition key switch.** This can be a push button or a spring-loaded ignition key switch. It allows the operator to either push or turn to signal the cranking circuit that the cranking motor process needs to start.
- **Cables.** The most ignored portion of the circuit. None of the other components will work if you cannot provide enough current at the proper voltage. The size of the cable is dependent on the amount of current that this portion of the circuit must handle. The large cables between the battery and cranking motor can see well over 1,000 amps in cold weather at 24 volts. The amount of current needed to drive the magnetic switch coil is four amps, so the wire size might be as low as 18 gauges.



Because of its mass, a battery takes a long time to change temperature. If a vehicle sits out all weekend in a zero-degree environment, it might take 30 hours to warm up the battery. Use the outside temperature, not the shop's.

For the cranking system to operate as designed, all of these components must work in conjunction and each component must be able to do its job in the correct sequence. Although electrical issues seem to be the most perplexing items for technicians, they need not be. Most misdiagnosis is not caused by not doing the correct test, but by doing the tests out of sequence. It is as simple as 1, 2, and 3: Check the battery pack, check the main starter cables, and then check the cranking motor control circuit

Battery pack

The first step is to start at the battery pack. This is the heart of the electrical system. If you don't have electrical problems and just want to confirm the battery pack is charged, the bank test that electronic testers offer will work well. But if you have electrical problems, you must first take all the battery cable off of the batteries. Each battery must be tested individually.

First, check the battery for physical damage. If the case is cracked or broken, or if the post is damaged

or loose, the battery needs to be replaced. If a condition exists that caused the damage, make that repair before the new battery is installed.

If it is a filler-type battery, make sure the water level in each cell is correct. If not, add clean water.

Make sure the stud or lead pad area of the terminal is clean and free of corrosion.

The battery should be at least 12.3 volts to conduct a proper test.

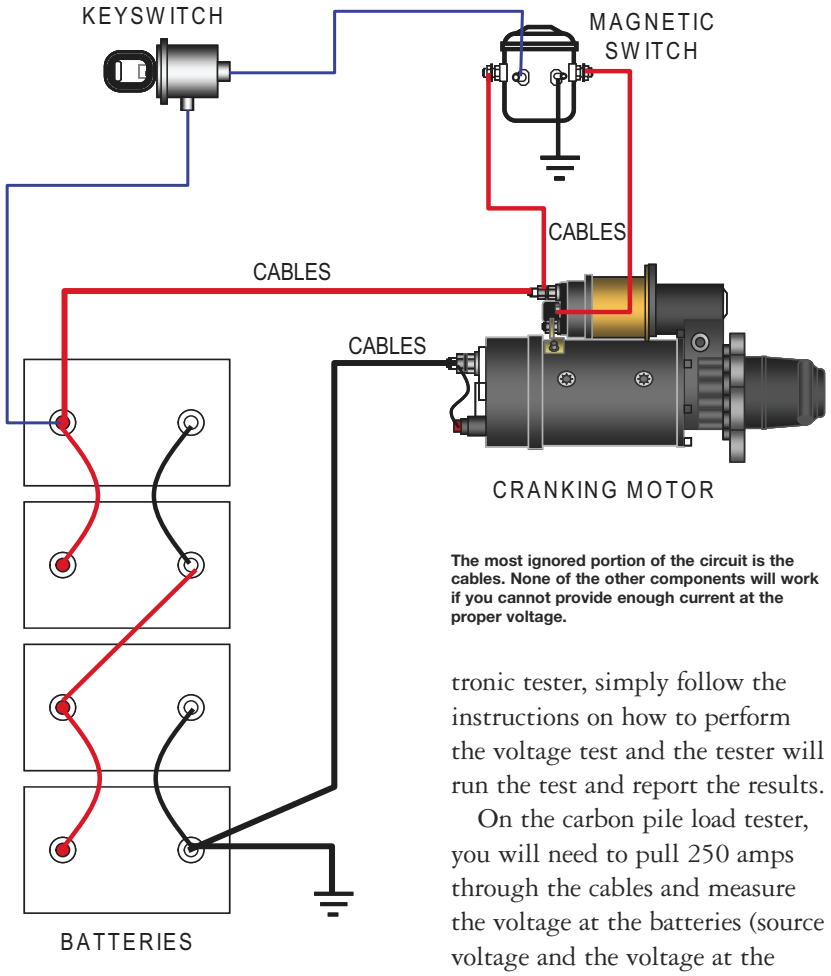
Check with your battery supplier for a recommended battery tester, and have him show your technicians how to use it. If you are using a standard carbon pile load tester, you still must use half the CCA for the load for 15 seconds. At 70F the voltage should be 9.6 volts or higher at the end of the 15 seconds. Less than 9.6 volts, the battery failed.

For every 10 degrees below 70F that the battery has been subjected, the minimum voltage should be reduced by 0.1 volts. For example, at 40F the minimum voltage would be 9.3 volts not 9.6. Newer electronic testers will typically adjust for temperature.

Because of its mass, a battery takes a long time to change temperature. If a vehicle sits out all weekend in a zero-degree environment, it might take 30 hours to warm up the battery. Use the outside temperature, not the shop's.

If batteries are connected in series, you have to treat them as a system. You must change both if one is bad. Each battery has its own internal resistance that will change with age, so if you put a bad one with a new one, you would over charge one and under charge one.

You now have good charged batteries in the equipment. Make sure the hold downs are securely holding the batteries in place. Then clean the cable connection and reattach to the batteries.



The most ignored portion of the circuit is the cables. None of the other components will work if you cannot provide enough current at the proper voltage.

Battery cables

An electronic tester (designed for 24 volts) or 24-volt carbon pile is required to test the main battery cables. Using a 12-volt carbon pile tester on a 24-volt system will damage the tester.

Connect the large lead of the tester to the cranking motor's battery post on the solenoid and the ground post of the cranking motor. Connect the small leads to the battery pack or a separate voltmeter. On an electronic tester, simply follow the instructions on how to perform the voltage test and the tester will run the test and report the results.

On the carbon pile load tester, you will need to pull 250 amps through the cables and measure the voltage at the batteries (source voltage and the voltage at the starter ending voltage) to determine your voltage drop. You are allowed 0.5 volts at 250 amps. Using Ohms law, divide 0.5 volts by 250 amps to calculate the resistance of the circuit. In this case it would be .002 ohms.

The last method to test cables is to use a clip-on ammeter to measure current while cranking and still measure the voltage at both ends of the circuit. For example, say you measured a 1.0-volt difference between the battery and cranking motor during cranking. If the current draw was 800 amps, the resistance of this circuit is 0.00125, well within the allowable limits. It will take

more than one person to conduct this test. It is also next to impossible to make repeatable because of the human factor of observing all of the meters at the same time.

Resistance in the cables (positive and/or negative) will cause voltage drop that could cause the cranking motor to lose speed during cranking. When you hear slow or dragging cranking, before you condemn the cranking motor, check the cables. Lots of cranking motors are replaced because of bad cables, not because the cranking motor is defective. This will result in warranty rejections and unnecessary removals.

If your cables are out of spec, take off both ends and clean them. Reconnect and retest. If this does not fix the problem, you might have to replace the cables. To reduce voltage drop, remember that the shorter the cable and bigger the gauge, the cable will have more ability to deliver energy at the other end. Cables are typically much cheaper than cranking motors or batteries.

Cranking motor control circuit

This critical circuit rarely ever gets tested. When one first turns the ignition key, it sounds like the starter begins to crank right at that moment. Not true. When one turns the ignition switch, current flows from the ignition key switch to the coil of the magnetic switch. The coil could draw as low as 2 to 3 amps, but when the coil is energized, this causes the large contact to move and it connects the two large posts on the magnetic switch. Now power to the cranking motors solenoid coils is provided from the batteries.

This current (up to 180 amps on a 24-volt system) creates a strong magnetic pull within the solenoid that causes the plunger to move toward the cap of the solenoid, thus the drive to move down the armature shaft in the opposite direction and engage the ring gear. When the contacts of the solenoid connect the battery and motor post, the cranking motor's armature and field are provided this energy and the cranking motor begins to turn. As soon as the motor begins to turn, the pull-in coil drops out of the circuit.

Temperature Vs. Load Voltage

VOLTAGE	TEMPERATURE
9.6	70F & Above
9.5	60F
9.4	50F
9.3	40F
9.1	30F
8.9	20F
8.7	10F
8.5	0F

For every 10 degrees below 70F that the battery has been subjected, the minimum voltage should be reduced by 0.1 volts.

This is important because the pull-in coil is much higher in its current draw. It is designed to produce the most force, but for very short periods of time.

Although this happens in a fraction of second, if the cables that connect the cranking motor's S-terminal to battery power are worn, pitted or damaged, the power to the S-terminal is reduced and the solenoid cannot do its job as designed. It will not be able to force the pinion in to mash with the ring gear and all the operator will hear is click, but no crank. Most heavy-duty cranking motors are designed so that if the pinion does not makes its full travel no rotation will happen. This is good design that keeps the pinion from milling the ring gear and causing expensive ring gear replacements.

This is the only test where the circuit will have to be disturbed. The S-terminal will have to be removed from the cranking motor. We have to apply a specific load to this circuit rather than using the solenoid coils. The solenoid might not operate and/or the load would be incorrect. In addition, the pull-in drops out as soon as cranking begins. The resolution of the tester's voltmeter will not allow for accurate testing.

When hooking up the tester, be careful as this is not at battery voltage now but it will be during the testing. Use care to make sure these connections do not touch ground.

Have someone turn the ignition key switch to start. You will hear the magnetic switch close and the meter will show battery voltage. Now draw 40 amps. Record the voltage at point A and point B. Run this test quickly, do it three times, and most magnetic switch contacts will rotate each time the magnetic switch is energized. You are allowed 1.0-volt drop in this circuit. If the drop is more, test each part of the circuit and repair as necessary.

If you conduct all of these tests and the cranking motor still does not operate, it is defective and must be replaced. While these seem like complex tests, they are much easier to do as compared to changing a cranking motor. **EM**

— Bruce Purkey is vice president of Purkeys' Fleet Electric Inc., a major supplier of electrical products to the transportation industry.

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