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WEB-ONLY ARTICLE: USE OF MTBF
Reliability expert and Plant Services blogger Daryl Mather’s new book, “Lean Strategies for Effective Reliability: Asset Resource Planning,” takes a different view of MTBF and looks at how companies are using this metric to implement modern maintenance techniques and objectives. Read Mather’s article on MTBF at www.plantservices.com/articles/2008/115.html, and scan all of the articles he has contributed to Plant Services at www.plantservices.com/articles/2007/130.html.

PODCAST: ECONOMIC STIMULUS COULD COME FROM INVESTING IN U.S. INFRASTRUCTURE
A World Bank commission says that countries with growing economies invest in their infrastructure. Commentator Robert Reich says that’s what the United States ought to do. Listen to this podcast and decide for yourself at www.plantservices.com/articles/2008/099.html.
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Motor Service

You have to appreciate expertise where you find it.

On the south side of Valparaiso, Ind., just north of Route 30, behind Duffy’s Bar on Axe Avenue, there’s a group of tin-roofed, cinder-block buildings roughly gathered around a weedy, potholed gravel parking lot. The simple, well-used structures house a set of businesses every town needs, but fewer have as time goes by. There’s Lucht Blacksmith & Welding, On-Site Services’ fix-it and small engines, L&S Auto Repair, Northern Indiana Door Service and the subject of this month’s column, Tholen Motor Service.

What do you do when, at the onset of a long, hot Chicago summer, your 83-year-old mom’s 40-year-old General Electric through-the-wall air-conditioner blows fuses and won’t run? Of course, you replace it with a new, modern, efficient unit. But what if your long-deceased dad had adapted it into a window seat, using his own hands to make unique and clever control extensions and custom air ducts, so no new unit would fit without major revisions? Maybe you’d do what I did – try to find out what’s wrong with the old one and get it fixed.

Dad made it easy to pop the chassis out, so I did that and took it home, plugged it into a 240-volt supply protected by a 20-amp circuit breaker and switched it momentarily to “Low Fan.” The blower motor lurched, threw sparks and made a large puff of smoke. Rotors and stators mystify me, but nuts and bolts don’t, so I took some pictures of how it goes together, excavated the motor, and carried it (along with its capacitor) to Mr. William Tholen, proprietor of the above-mentioned Motor Service.

Tholen’s one-man shop is about 14 feet wide and 30 feet deep. Enough space for a small, well-worn counter for one or two standing customers is given over to folks like me; the balance is filled with benches, instruments, machine tools and work in progress. On a warm day, open front and rear doors provide cross-ventilation.

At this point I must mention that this isn’t the original fan motor – that was replaced two years ago by trained HVAC professionals. My intention was to find out what went wrong with it after only two years so I could decide whether to repair or replace it, or deal with the great unknowns of finding and putting in a whole new air conditioner. Of course, I hoped to avoid the cost of another motor and the HVAC shop’s labor charge.

Tholen isn’t as old as my mom, but he’s definitely my senior and speaks with the heavy Dutch or German accent I’ve often found associated with an appreciation of fine old machinery and the desire to keep it working properly. “Sparks and smoke, you say?” he exclaimed as he peered at the motor with obvious enthusiasm. “Write your name and number on this piece of paper, I’ll call you when I’ve looked at it tomorrow morning!”

Right on time, Tholen called to tell me the motor couldn’t be repaired, and offered a replacement at (“Are you sitting down now?”) about $220 with tax and shipping. I asked him if he could tell me why it failed, because it wouldn’t be worth replacing the motor for just another two years of service. He said it had been fitted with the wrong capacitor. “It should be 4 microfarads, and it’s a 10, so the motor was drawing 1.5 amps instead of 1.1. That might be the reason,” he said. “The new motor will come with the right capacitor.”

Wow, I thought, $220 is a lot to spend on this old air conditioner, especially since it probably uses twice as much electricity as a new, Energy Star-rated unit. But on talking it over, we decided some things are worth keeping even if they’re not the most efficient option. At least we wouldn’t be scrapping it.

I had already found a new motor on the Web. I could have thanked Tholen for the bad news, ordered the motor myself, and had it and the capacitor delivered to my door for about $160. Instead, of course, I asked him to get it for me.

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I found your article (“Stimulation conundrum,” June, p. 7, www.plantservices.com/articles/2008/111.html) and have an answer, one that I’ve been contemplating. Because we are to get a tax refund from dear old Uncle Sam, the one thing that most people forget is that this will be considered as income for the next year if I’ve learned anything at all from doing my own taxes. Now, if I’m wrong, it will surprise me, and, rest assured, our government will find a way to get it back twofold.

My plan is to help out the new energy-producing companies and also give myself a tax cut for the next year. By investing in, let’s say, solar panels to produce energy, I can reduce the cost of normal operations in my household, get a tax break with the government because of tax rules, and loosen the grip that the electric companies have on me. Not to knock the electric companies, but one thing I don’t like is monopolies, and that is what electric companies are, no matter how you look at it. I don’t hate them; they do a very good job in our area most of the time, but you just can’t shop around for other suppliers of their product to get the best price. I understand that the up-front costs of energy alternatives are great, but in the long run it helps everyone, even if they don’t want to be helped. I will get started on a new energy project to help me in the future.

One final note on this subject: This money isn’t a gift from our government; it’s a gift from you for being such a good person to hire people to manage our affairs with the other people of the world. These are people who really don’t care about you but have been taking our money for years. They’re finding another way to increase their costs for doing the same thing that our forefathers did for nothing.

Mark Hose, maintenance department technician
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How many times have you gone to work hung over or stoned, or have known about others you work with who have done so?

According to the American Council for Drug Education (ACDE), more than 70% of substance abusers hold jobs. One worker in four, ages 18 to 34, has used drugs in the past year, and one worker in three has knowledge of drug sales in the workplace. The ACDE reports that Americans consume 60% of the world’s production of illegal drugs, and that 23 million use marijuana at least four times a week. Another 18 million abuse alcohol, 6 million regularly use cocaine and 2 million use heroin.

A recent study conducted by the World Health Organization (WHO) reports that the United States leads the world in illegal drug use, followed closely by New Zealand. So when you hear electrician Fred Delahunty’s story, one could very easily imagine trading places with him. He works in the pulp and paper industry for ABB at Kawerau in the Bay of Plenty, New Zealand.

One day – one second – is all it took to put his life in jeopardy: A 3,300-V switch blew up when he was 2 feet in front of it. Delahunty was burned over 60% of his body and he languished in a burn unit for 3½ months, 46 days of which he was unconscious. “I was given a 0% chance of living,” he recalls.

If you’ve ever had the privilege of hearing Delahunty speak about his experiences, the images he shows of his charred, bloated body are ones you’ll never forget – nor should you. They’re pictures of what really happens when you work with people who are careless about workplace safety. Those who are addled by drugs or drink can easily slip into unsafe work practices that put everyone at risk.

“I knew I was hanging onto life by a cotton thread,” Delahunty says. His fight to avoid becoming a workplace statistic began in earnest when he regained consciousness. “I couldn’t afford to think negatively,” he says.

Along with his wife’s and family’s support, Delahunty says, “I used my mind to think my way out of it.” He began by squeezing a squash ball as many times as he could, and then put in another set of squeezes. He reached a milestone when he took four steps with the aid of crutches. “Each step was like I had won a gold medal,” he says. “Once I got out of the bed, I was never depressed. I knew what my target was.”

He endured four years of operations, skin grafts and all the horrors of dealing emotionally and physically with a life-changing accident. But he made the most of it.

“Why sit back and waste it?” he thought. That’s when he began giving presentations about his experience. “This can really happen – we can really get killed in the workplace. An accident can build until something like this happens. Don’t end up going on the journey I had to take,” he cautions.

Delahunty was an athlete before the accident, and remains one to this day. It’s what helped get him out of the burn unit and back to a new kind of normalcy. “I refused to let this accident rule my life,” he says.

When he got home from the hospital, he set up his bicycle on a stand in his garage so he could train for the Lake Taupo Cycle Challenge, a 100-mile bike race that he participated in before the accident. After months of training and perseverance, he cycled through the race and was only three minutes slower than his fastest time before the accident.

He even went back to work at the same paper mill where the accident took place. His experience was a catalyst for change in the organization, and the company’s approach to safety has been overhauled. “We get complacent about what we do because we’ve never had an accident,” Delahunty says. “I had a good reputation of never working dangerously, but it was a bad atmosphere to work in. These guys [who I worked with] took bad risks and their bad work practices transferred onto me.” If Delahunty’s words set off alarm bells of recognition within you, be honest with yourself and your maintenance team: Fix the problems now before someone gets hurt. “People with a drug problem or alcohol problem – don’t make any excuses – you can’t work safely,” he warns.

“If you haven’t had an accident yet, it’s not good planning, that’s good luck.”

E-mail Managing Editor Lisa Towers at ltowers@putman.net.
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Future Pondered at RSTechED
Seers say manufacturing must embrace the Age of Information

Attendees of the 2008 RSTechED, hosted by Rockwell Automation, learned how to glance into the future this week and envision how their companies may look a little brighter because of it.

“The issue is no longer simply access to information,” said Kevin Roach, vice president of Software, Rockwell Automation. “It’s how the sea of information generated from many systems is rationalized across the enterprise into succinct and useful context.”

The ability to contextualize information, adapt and make innovative decisions that could change the course of a manufacturer’s future were among key concepts discussed at the 11th annual RSTechED, as more than 1,500 registered attendees gathered for the weeklong user and partner event June 1-6 at the Rosen Shingle Creek Hotel, Orlando, Fla.

“Innovation is going to fuel the manufacturing engine of the future,” Roach said. The most commonly successful form of innovation is “combining existing technology in new ways,” Roach added. He pointed out how the iPod has changed the way people listen to music by combining several technologies. It worked because Apple understood its market. GPS systems are another example.

As we go forward, there will be less time spent on worrying about getting the right information and more time acting on it, according to Roach. “Just because we don’t know how to do something today doesn’t mean we won’t be able to do it tomorrow,” he says.

Tuesday’s keynote speaker was Alvin Toffler, “futurist” and author of “Future Shock,” “The Third Wave” and (with his wife Heidi), “ Revolutionary Wealth.” Addressing the need to change how work is done in the future, Toffler discussed how macro trends affect the future of business segments and, in turn, can define a company’s success for decades to come.

Commenting that manufacturing output is growing as manufacturing employment declines, he said, “We are entering a revolution of wealth creation … a shift from muscle power to production based on ‘mind.’ Knowledge is a different input as a resource because everyone can use it.”

Recent breakdowns in the system such as the mortgage crisis, response to hurricane Katrina and others are systemic, Toffler explained, and are symptoms of the growing mismatch between the needs of our current industrial-based manufacturing society and the growing knowledge revolution.

That’s not all bad. “Even in chaotic situations, there are desirable patterns,” he says. “It is a mistake to assume current chaotic situations are bad. The crises are systemic.”

Held in conjunction with RSTechED, the Manufacturing 2.0 Executive Forum was themed “Fueling Your Innovation Engine” and focused on best practices in terms of leveraging an IT-driven approach to manufacturing that couples product and business planning, supply chain processes and plant operations into one efficient and responsive enterprise.

Representatives from IBM, Cisco, OSIsoft and Smithfield Foods provided manufacturers with a better grasp of coming changes and how to use them to help their enterprises prosper in tomorrow’s business environment.

Attendees also could take in any of five two-hour customer panel discussions of key industry trends, including using asset-management software to protect intellectual property and leveraging existing plant-floor investments. Lively discussions throughout the event featured panelists from Wyeth Biotech, Chrysler LLC, Kimberly-Clark and Tyson Foods Inc.

Eager to help bolster manufacturers’ information prowess, Rockwell Automation announced availability of a new version of FactoryTalk ProductionCentre, which helps users deploy and scale manufacturing production applications across multiple sites. The latest version delivers comprehensive production-management functions, along with advanced decision support tools to help manufacturers track and control production, reduce cycle times and excess inventory, analyze root cause and failures, and track and manage factory and field repair orders.

Future products available for preview included FactoryTalk ViewPoint and FactoryTalk Metrics, and attendees were able to participate in discussions about the affect of the recent Rockwell Automation acquisitions of Pavilion Technologies and Incuity Software.

For more about RSTechED, see www.rsteched.com.
Dealing With Flood-Damaged Electricals

Littelfuse reminds us of the hazards associated with working around electrical equipment that has been exposed to flood water, and provides instructions for a safe restoration. Flood waters are generally contaminated, and can leave conductive and corrosive residues inside equipment that can produce shock and fire hazards. Affected equipment should be replaced or refurbished to avoid risk of fire and shock.

Replace any fuses that were submerged, even if they look dry on the outside. Fuses contain filler materials such as sand to quench the arcs that form when the fuse elements open. The filler material might absorb water and compromise the fuse's ability to safely interrupt an overload or short circuit. Because of the fuse's body design, the filler material won't dry out, so all fuses need to be replaced.

Avoid mixing fuse brands in a three-phase application. Replace the three fuses with the UL Class and rating from the same manufacturer because performance among fuses can vary slightly.

To enhance performance and reliability, replace non-current-limiting fuses such as old-style UL Class H or Class K5 with Class RK5 or more current-limiting Class RK1 fuses. Class RK1 fuses have the same physical dimensions as UL Class H, K5, and RK5 fuses, but provide better protection for personnel and equipment. Standardizing on Class RK1 fuses simplifies the job of preparing equipment for restart and contract electricians need to stock only one type of fuse.

Checklist for electrical system restoration

Non-experts may not understand the special concerns of electrical safety during flood cleanup, so Littelfuse offers a set of 13 electrical safety tips for flooded equipment (see www.plantservices.com/industrynews/2008/086.html).

Examples include:

1. Make sure the power actually is disconnected. Before evacuation, power should have been shut off at the main service switch. If the switch was left in the “on” position and the utility disconnected power outside the building, have an electrician inspect the facility to ensure the power is actually "off" before other workers enter the premises.

2. Inspect the surrounding area for standing water. To protect workers, use a portable ground-fault circuit interrupter (GFCI).

3. Identify electrical equipment that was or might have been submerged. It is hazardous to simply allow equipment to dry and then re-energize it. Some equipment can never be reused, and must be replaced. Any reusable electrical equipment that has been wet shouldn’t be used until it has been serviced by an authorized electrician or service center.

4. Inspect electrical equipment that wasn’t submerged. Even if electrical equipment wasn’t submerged, a qualified person should inspect it to determine whether moisture has entered the enclosures.

More detailed information on what equipment might be refurbished and reused and what must be replaced is available in a set of NEMA guidelines titled “Evaluating Water-Damaged Electrical Equipment.” The full text is available at www.nema.org/standards/water-damaged.cfm.

Stress the importance of following these and other necessary safety precautions when working on flood-damaged electrical equipment. The conditions this environment presents make this a time to be especially aware of safety procedures. Following this checklist for electrical system restoration will reduce hazards for both equipment and personnel.

Resources

Appreciate EAM
An entertaining and informative mini-book, “The Business Impact of Enterprise Asset Management” covers topics like the aging workforce, the changing role of the plant engineer, green initiatives and risk management from an EAM-centric perspective. Here are tips and information that can be used at any level of an organization by individuals who are responsible for or are interested in managing critical assets. Attendees at IBM’s recent Pulse 2008 user group meeting received copies, and you can get yours at the company’s EAM Resource Center, www.eamresourcenter.com.

Prepare for hurricanes
National Oceanic & Atmospheric Administration (NOAA) Climate Prediction Center experts have projected a 90% chance of a near-normal or above-normal hurricane season. Kimberly-Clark Professional’s hurricane-preparedness Web portal offers information about how to prepare for a hurricane, protective equipment, biological and other hazards, and more. Workers involved in hurricane response, clean-up and remediation can find it at www.kc-safety.com/hurricanereief.

Industrial Web store now has more
Amazon.com announced expansion of its Industrial and Scientific store to include lab supplies, electronic components and metal-working, now offering “anything from stainless steel tubing, to surface mount capacitors, to indexable carbide inserts, to plastic beakers, to Mil Spec machine screws, to casters to roller bearings to respirators.” Corporate accounts allow business to pay at the end of the month for that month’s purchase orders, and buyers now may create their own lists for consumable items they purchase frequently. See www.amazon.com/industrial.
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How can U.S. companies compete in a global marketplace when the rest of the world is quickly catching up to the United States’ enterprising advantages? How can businesses succeed when the majority of our skilled workforce is entering retirement age?

These are some of the questions that our nation’s leaders are now grappling with as we move forward in the 21st century. Recently, Deborah Van Opstal, vice president of the Council on Competitiveness (www.compete.org), thanked me for providing leaders within the Beltway with an “Aha!” moment about the competitive advantage that maintenance and reliability can provide for organizations in the United States.

This time, the visit to Washington, D.C., was a dream trip. Council on Competitiveness members and Sens. Max Baucus and Richard Lugar convened a briefing on Capitol Hill to address how the United States can achieve a competitive advantage in the global skills race. The briefing was held in conjunction with the release of the Council’s latest report, “Thrive. The Skills Imperative” (www.compete.org/publications/detail/472/thrive), calling for a national agenda to bolster U.S. workforce skills and ensure a rising standard of living for all Americans. This time I was invited for my mouth, not just my ears.

To industry, the maintenance and skills crises might be old news. However, as I learned firsthand, D.C. politicians are involved in so many issues that they’re detached from advances made in the maintenance and reliability sector. It was a privilege and honor to inform them of the opportunities and contributions maintenance can provide. Believe it or not, they played the “Maintenance Crisis Song” and PowerPoint presentation on Capitol Hill. Dozens of people walked by, and I’m sure they were wondering what was happening in our chamber.

Later, we had the opportunity to meet privately with some senators. Have you ever had a “Forrest Gump” moment? If you’ve seen the movie, you probably remember the scene where Forrest met President John Kennedy and, upon shaking his hand, exclaimed, “I gotta pee.” Well, that popped into my mind when we had the opportunity to meet JFK’s youngest brother, Sen. Ted Kennedy, on April 30. My mind was racing in so many directions because I was so nervous. Normally, I don’t get star-struck, but this was an American legend and he had scheduled 30 minutes of time in his office for those of us on the committee. That was two weeks before we heard the news about his brain tumor. I cherish those moments even more now, and pray for him and his family after hearing about his diagnosis.

During the meeting, I asked Kennedy why Harvard and MIT MBA programs aren’t teaching the value of maintenance. At first he was confused, but later he got the point that if properly managed, business can convert maintenance, which is commonly perceived as a necessary evil, into a competitive advantage.

I met with Sen. Richard Burr and with staff members from Sen. Lamar Alexander’s and Sen. Harry Reid’s offices. In addition, there were representatives of Sens. Obama, Clinton, McCain and numerous other Congressional leaders in the briefing.

I also had the opportunity to attend the American Competitiveness Summit in Chicago, sponsored by the Department of Commerce. During this event, I met with Treasury Secretary Henry Paulson, Secretary of Commerce Carlos Gutierrez, South Carolina Gov. Mark Sanford, President of the National Association of Manufacturers (NAM) and former Michigan Gov. John Engler, and numerous other dignitaries, including Harvard MBA professor and best-selling business book author Dr. Michael Porter. I also challenged Dr. Porter as to why the value of maintenance isn’t taught in Harvard MBA classes. He took my question under advisement and perhaps will take that concept back to other educators at Harvard.

Next month, I’ll outline more steps our nation can take to advance our competitive advantage and profit from reliability and maintenance performance.

If you would like to see the briefing on Capitol Hill, visit SkillTV.net, and as always, please contact me if you have any questions or suggestions.

E-mail Contributing Editor Joel Leonard at jleonard@putman.net.
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radio-frequency identification (RFID) technology identifies the raw materials, spare parts and other items entering your facility, the equipment that processes them, the product leaving your plant, and even the trucks and people that transport them.

Wal-Mart encourages suppliers to identify their larger and more valuable products using RFID. So whether you think RFID chips away at our privacy or envision it enabling higher levels of productivity, there’s no denying it’s sweeping the world.

RFID devices have been around since World War II, when they identified planes as friend or foe. RFID, along with bar codes and smart cards, fall under the automatic identification family of technology. Despite RFID’s history, it’s only recently that its cost has made it commercially competitive. However, it’s unlikely you’ll see tags on inexpensive objects.

The typical RFID system has three components: the tag, the reader and supporting hardware/software.

Tags are transponders
A tag has a tiny antenna and a chip to store information. Some tags can have a micro-battery.

Like a bar code label, the RFID tag is affixed to an asset, but the RFID tag is more versatile, albeit at a higher price. RFID tags with a power supply can read information off of the transponder with greater accuracy and from a greater distance.

Another advantage over bar coding is that RFID uses radio waves, so you don’t need a direct line of sight with the reader. You can read multiple tags simultaneously; in harsh, wet and corrosive environments if necessary; and through materials if the tag is inside a vehicle or container.

The flip side is that tags can be hidden for easy tracking. This raises the ire of unions and groups that claim management could surreptitiously track maintenance technicians.

There are essentially two tag types: active and passive. They vary in terms of how signals are received and transmitted, although there are variations on these themes.

A passive tag can be read even though it has no internal power source. It’s the simplest and cheapest RFID type. A radio signal from a reader induces in the tag’s antenna just enough power to awaken the tag’s chip to transmit a weak response. Read-only passive tags are preprogrammed and the information stored in the chip can be read, but can’t be changed. Other passive tags are read-write, meaning their memory can be changed easily. Although they’re more expensive, they offer greater flexibility. For example, they can be reprogrammed when their original asset is retired.

An active tag can transmit a stronger signal because it has its own power supply. It can identify equipment passing a checkpoint several hundred yards away. These tags are larger to accommodate the battery and last only as long as the battery functions, which can be as long as 10 years. Active tags can be handy for storing and transmitting to your CMMS an asset’s condition-based data, such as temperature or vibration. When purchasing RFID tags, consider these factors:

Working environment: If you’re working in a harsh, hot or humid environment, select a tag that functions reliably.

Location: Another factor is the material in the immediate vicinity of the tag. Many tags are weakened or rendered useless by simply wrapping them in aluminum foil. Location dictates what form the tag takes. For example, you’d use a different shape of tag for embedding an RFID device on an employee badge than inside some production equipment.

Range: The shorter the operating range, the less expensive the cost. Production equipment involves shorter distances because the readers and equipment are in fixed locations.

Size: Long-range RFID tags are larger, especially if used under unforgiving conditions.

Frequency and regulatory compliance: Ensure that the frequency ranges are acceptable for a given country or region so the tag is compatible with foreign interfacing devices.

Readers may write
Some RFID readers, known as interrogators, are handheld devices for portability, such as for a technician conducting a
PM inspection. Others might be in fixed locations to recognize equipment, people and material passing by. The reader’s purpose is simply to transmit radio waves to one or more tags and capture the stored information.

Supporting the CMMS
The CMMS can be integrated with the reader to feed raw information into the appropriate database and application. Applications that can use RFID technology include:
- Condition-based monitoring, where the tag feeds continuous or batch readings to generate work orders or alarms.
- Time and attendance, where the RFID device tracks people coming and going from a given work area.
- Asset tracking, where mobile equipment or other assets on the move are tracked by fixed readers at known locations.
- Preventive maintenance, where technicians scan the equipment and spare parts used for facilitating data entry of work-order information.
- Inventory control, where parts are scanned at receipt, picking and placement into a given asset to facilitate data entry and the locating of parts.

Cost/benefit analysis
As larger companies adopt RFID technology, the cost of tags and readers will continue to fall. However, there’s still a long way to go for low-volume, low-cost applications where the bar code still rules as the most cost-effective solution.

Bar codes always will have a place in that they can do the job for less than a penny per bar code label. This would be difficult to beat, even after many more years, because an RFID tag is so much more complex than a simple paper and ink label.

(Editor’s note: The Plant Services CMMS/EAM Software Review, posted at www.PlantServices.com/cmms_review, provides a side-by-side comparison of more than a dozen popular software packages.)

E-mail Contributing Editor David Berger, P.Eng., partner, Western Management Consultants, at david@wmc.on.ca.
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Sanitary applications: Some industries are subject to stringent government and industry sanitary standards. Sanitary diaphragm seals eliminate dead spaces, thereby preventing bacterial growth and contamination in the connection. Wika’s Inline seals, mounted directly into process lines, make them well suited for such applications. The self-draining design simplifies cleaning. “The sanitary Inline diaphragm seal is installed between two flanges, becoming an integral part of the pipeline. It replaces the conventional T-piece,” says Raimund Weissner, Wika technical director of diaphragm seals.

Clamped sanitary diaphragm seals that compress the gasket can impinge on the active pressure-sensing area of the diaphragm. PI Components virtually eliminates the “clamp effect” with its improved-finish sanitary seals and patented attachment technology.

Biodiesel and ethanol: Biofuel processing is subject to the same harsh environmental conditions, mechanical vibration and process pulsation found in oil and gas processing. Breaks in the threaded gauge-to-seal connection can compromise readings or lead to system failure.

Wika’s all-welded system integrates the process gauge and diaphragm seal into a single assembly, and each connection and leak path is welded. “[The] system is leak-free, tamper-resistant and durable – a true dual-containment system,” Weissner says. “We are seeing a lot of growth in the acceptance of the all-welded approach because it reduces shutdowns, improves safety and controls emissions.” A flushing port helps remove residue to prevent damage and clogging.

Pulp and paper: The manufacture of these products involves viscous, aggressive and hardening media. PI Components’ flush diaphragm seal won’t allow debris to plug the impulse lines, so the measurement remains accurate. The company developed a super-duplex diaphragm material to handle black liquor applications.

Wika’s pulp and paper units meet the industry’s seal specification and process-connection requirements. An optional Wikaramic coating can be applied for protection against scouring and premature diaphragm wear.

Nuclear power: In this industry, safety, reliability, stringent design and manufacturing quality control are foremost concerns. The Model 1159 remote diaphragm seal by Rosemount Nuclear Instruments is a threaded remote diaphragm seal that has been tested to IEEE’s qualifications. Combined with Rosemount’s nuclear-grade pressure transmitters, it supports boiling water and pressurized water reactors.

Seal software: With so much to consider and process reliability at stake, some seal manufacturers offer selection software. Rosemount’s Instrument Toolkit eliminates transmitter and seal combos that don’t meet your requirements. The software factors in conditions that affect performance to calculate the transmitter/seal performance. It also produces reports, installation drawings and specification sheets.

BAscal, Badotherm’s seal program, lets users select the seal/transmitter combination for the needs of the application. The Windows-based package aligns Badotherm seals with well-known industrial transmitters. It then calculates the performance based on the application data.

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For more information, see:
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Across asset-intensive industries, top management’s demands for lower costs and higher profits have driven increasingly sophisticated maintenance strategies. Reliability and maintenance professionals are making great strides toward shedding calendar-based maintenance activities by using vibration, fluid analysis, thermography, motor circuit analysis, ultrasound testing and other services and technologies.

Condition monitoring is a mature discipline with robust solutions resulting from decades of development. But while developers of computerized maintenance management system (CMMS) or enterprise asset management (EAM) packages are steadily adding capabilities for handling condition-monitoring tasks and opening their technology platforms for greater connectivity, CMMS and condition-monitoring systems still aren’t capable of being plugged directly into each other. To fill the gaps, end-user organizations have turned to a cornucopia of solutions, from database and analytical software solutions to real-time controls, to improve efficiency and reduce risk.

When condition monitoring meets management systems, the concept of condition-based maintenance (CBM) becomes possible. The concept traces back
decades in military applications, and represents an ideal that some might say has never been realized. Even the definitions of CBM – and updated “CBM+” – are varied enough to defy an accepted standard. But a simplified, serviceable definition is “Tracking the condition of equipment and assets to perform maintenance activities only when the variables of an asset or piece of equipment indicate the risk of an impending failure.”

Consultant Alan Johnston says, “Historically, CBM has had greater emphasis in aerospace and defense, in the process industries and at utilities, where there’s an extremely high cost related to an unpredicted failure. People can die ... aircraft can crash ... nuclear subs can go boom.” But how are we doing at bringing CBM to bear on the more prosaic problems in typical manufacturing plants?

Open O&M: Standard of standards

When he’s not at his desk at Alabama’s Redstone Arsenal, Johnston is active as president of the Management Open Systems Alliance (MIMOSA), or chairing Open O&M, a superset of standards groups promoting integration between the worlds of reliability and maintenance with enterprise computing and risk management. Open O&M is an amalgamation of standards groups (ISA, OPC Foundation, WBF and OAGi) whose mission Johnston defines as “a group of standards organizations that have agreed to work with each other to make their standards interoperable, so their products and systems based on those standards will also be interoperable.”

Why is the scope so broad? Because, he explains, “The corporate guys don’t generally come down to the maintenance department and ask those guys for their viewpoint on interoperability standards.” It’s up to maintenance leaders to “step up and be true peer partners with their enterprise systems counterparts in the organization … If they don’t, decisions will be made without their input.”

The core MIMOSA architecture might well provide the best backbone for CBM by facilitating the integration of three major components: reliability management, maintenance management and condition management (Figure 1). Each of these is broken into pieces. For example, “open condition management” starts with sensors, data input and manipulation, alarms and events, diagnostic health assessment and prognostic assessments.

The current state of automated condition-managing tools, according to Johnston, is at the level of diagnostic health assessments, where vibration tests, portable data collectors and other means are used to collect data, plot trends and analyze the deterioration and usable life span of assets. This is akin to a doctor who knows what’s wrong.

But that doctor can’t give a prognosis without a broader knowledge of what’s going on. In a CBM context, even if systems are capable of coming close to root-cause analysis, integration is generally insufficient to close the loop with automation. So, the next frontier for maintenance technology is in this area of prognosis assessment.

Communication and context

Operations and maintenance used to be separate, but management philosophies and advances in technology are bringing them together. Business standards such as industrial Ethernet and Microsoft-based connectivity standards

SONGS reaches silos

One of the largest U.S. nuclear power plants, the San Onofre Nuclear Generating Station (SONGS) in San Diego County, Calif., recently tied its varied condition-monitoring systems to the Ivara EXP Enterprise performance-management “middleware” system and is now interfacing that to SAP’s Plant Maintenance module.

The Ivara solution develops condition-based activities by defining the frequency, scope and related information, and sending it to SAP to be managed. The system aggregates information from “siloed pockets of data” that have now been narrowed to two main data systems (one for nuclear and another for conventional fossil fuel and hydroelectric power). Despite the availability of off-the-shelf interfaces, the project team wanted more application-specific integration. The team, led by Darryl Barney, monitoring and asset reliability system product manager, integrated several systems and included standard interfaces as well as custom programming of 17 connections between Ivara and SAP to collect condition-monitoring data where the plant wanted deeper-than-standard functionality. “Fortunately, our databases were in Oracle so we were able to use a single, common interface,” Barney says.

Integration efforts have in part been prompted by the need for continuous improvement and meeting a critical reliability standard (INPO AP-913). But the results of having a seamless, central repository include reducing some task times from hours to minutes.
RELIABILITY
Condition Monitoring

Mohawk keeps tabs on paper
A paper machine is roughly the size of a football field and houses a "microcosm of hundreds of different machines and controls working in unison," says Paul Stamas, vice president of information technology at Mohawk Fine Paper, Cohoes, N.Y. Across five plants and additional converting facilities, the company tracks as many as 20,000 data points.

A mix of discrete, batch and continuous process operations call upon real-time controls and software from ABB, Rockwell Automation and GE Fanuc. An OSIsoft Pi process historian serves as a "giant octopus" that connects once-disparate data, and now trends and correlates time and events such as paper machine speed, ambient temperature and energy usage.

“Our plan is to feed condition-based data from the factory floor into Pi, and then into the Infor EAM system,” Stamas says, going live in June. He says that Mohawk, with revenues under $400 million, is the second-largest producer of wind power in U.S. manufacturing (behind much-larger Johnson & Johnson). “For both economic and socioeconomic reasons,” he says, the company is considering adding Infor’s new Asset Sustainability Edition.

CBM in the bull’s-eye

Figure 1. The MIMOSA architecture supports CBM by facilitating integration of reliability, maintenance and condition management.

have been adapted for industrial use, and computing intelligence has been distributed down to the lowest levels so that motors and pumps – any asset with a microchip – can be put to work in a CBM environment.

So it’s no surprise that automation engineers have been broadening their solutions to include maintenance modules. For example, GE Fanuc (www.gefanuc.com) in April announced the addition of a Maintenance Gateway module to its Proficy automation software suite. The system can reside on the plant floor, in the maintenance department or in both places. “It doesn’t matter,” says Mike Yost, Proficy product marketing manager, adding that “the same performance OEE [overall equipment effectiveness] number is seen across the entire platform” for quicker identification and correction of problems.

Similarly, major distributed control system (DCS) suppliers, including Emerson, Honeywell and ABB on the process side, offer what tech-analyst firm ARC Advisory Group (www.arc-web.com) calls a “plant asset management” (PAM) system. PAM software is part of the DCS and directly communicates with sensors to predict failures, alerting the plant users to equipment problems as well as inte-
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In April 2008, Dow Corning’s Midland, Mich., plant went live in the process with the Stress Wave Analyzer condition monitor from Invensys (www.invensys.com). The technology is an integrated version of SWANtech’s ultrasonic-based “stress wave analysis” condition-monitoring technology, which can be applied as an alternate to vibration, temperature and lubrication debris monitoring tools (http://swan tech.curtisswright.com). It’s integrated with the plant’s Foxboro DCS.

Sixth Sense Processware, Mississauga, Ontario, has interfaced data-managing software with IR cameras from FLIR Systems (www.flir.com) to provide real-time safety alarming, as well as minute-by-minute data trending “to predict how many heating cycles remain until a ladle needs maintenance,” says John Craven, president of Sixth Sense. “We might see that based on the rate the refractory has been thinning, they might only have three more uses, and can schedule maintenance knowing they will have that ladle out of commission for a week.”

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indicator lights and similar meters and alarms. These allow the user to view an asset and dig down in the hierarchy to view trends from the plant down through a single asset.

“What we see today with CMMS or EAM applications is that the information is much closer to real time than it was just a couple of years ago,” says Anders Lif, global industry director of manufacturing and logistics for IFS World Operations (www.ifsworld.com), speaking for IFS North America. OEE, which was in the past a lagging indicator of plant uptime and productivity, is now being used as an almost instant indicator of production-line performance. With operations and maintenance personnel increasingly working together, he says, “Business applications and CMMS systems are moving very much toward the same set of rules operators live by in the SCADA [supervisory control and data acquisition] environment.” For that reason, he sees IFS customers seeking both more integration with factory floor systems and KPI-oriented displays.

Systems also have added features for better management of maintenance and, specifically, condition data, such as triggering an alarm or message (on-screen, e-mail, text message) if asset conditions exceed upper or lower control limits, or simply triggering a preventive maintenance (PM) routine if all is well. They can trace multiple variables for a piece of equipment and support Boolean “and/or” logic to configure and display combined indicators. Users also can drill down in the system to validate that when an alarm triggers, it’s not a system error, before responding.

This type of user interface provides “just what’s important right there in the browser,” says Paul Stamas, vice president if information technology at Mohawk Fine Paper, Cohoes, N.Y. (see sidebar on p. 26).

“If a dial creeps up into the yellow zone, we know we need to view that item in more detail, and think about this valve or that motor, or do some preventive action that will be right behind that dial in the interface. It’s not so much about an event; it’s more about continuous monitoring.”

Mohawk chose a system from Infor (www.infor.com) for its maintenance department, and is considering upgrading to its new Asset Sustainability Edition to perform con-

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Sensors predict their own demise
Smart-transmitting sensors installed in real-time process control systems can not only transmit self-diagnostic data, but also play an important role in multivariable condition-monitoring efforts. The Ingold line of pH and dissolved oxygen sensors from Mettler-Toledo (www.mettler-toledo.com) adds a smart chip in the sensor tip itself, not just the transmitter. As part of a process plant’s distributed control system (DCS), it can send pH and dissolved oxygen data as well as indications of signal quality based on real-time impedance measurements, and comparisons of calibration trends to spot sensor degradation.

Some plants, such as wastewater, are likely to use pH sensors in run-to-fail mode. But in a refinery, loss of pH control can damage process pipes; in biotech, off-spec can kill active cells and reduce productivity.

The sensor-and-software solution includes a “dynamic life indicator” based on actual conditions, “so you go into a predictive cycle, where the sensor tells you it’s time to recalibrate or replace,” says Roger Govaert, engineering, procurement and construction projects manager with Mettler-Toledo Ingold.

But, by monitoring energy use, the demonstration shows that the asset with the more expensive filter is running at near-peak efficiency, while the asset with the less-expensive filter degrades to 60% efficiency. Instead of saving roughly $400 annually with a less-expensive filter, the maintenance department finds that the higher-priced filter can save them nearly $5,000 in reduced energy costs.

These benefits point to the great potential for real-time CBM, and how CMMS/EAM system designers are beginning to capitalize on it.

Math in the middle
ARC’s Chin names Ivara (www.ivara.com), Meridium (www.meridium.com) and SmartSignal (www.smartsignal.com) as...
emerging solutions for advanced maintenance techniques that complement condition-monitoring systems but operate as a generic, or “hardware independent,” layer of software. In Meridium’s words, they provide “a much broader scope of data that isn’t tied to a specific hardware manufacturer.”

Large sites that back their maintenance staffs with reliability engineering are familiar with methodologies such as reliability-centered maintenance (RCM) and failure mode and effects analysis (FMEA). Based on those methods, Ivara puts data in the context of work flows in a unified database environment that can connect to each activity and source of asset health, including maintenance and operator inspections, predictive technologies like vibration and lubricant analysis, as well as integration to online sources such as data historians and supervisory control and data acquisition systems,” says Eric Wegscheider, director of product marketing for Ivara. “We bridge the divide between these different islands of data that you’ve already got and bring them together into one supporting platform.”

SmartSignal’s EPI*Center software also serves large, often continuous process-industry sites involving tens of thousands of asset data points. It doesn’t replace systems from Ivara or OSIsoft or others, but can augment them with advanced modeling and pattern-recognition tools that expand “to a tremendous degree” the analysis of “anything that can be measured with any kind of sensors or instrumentation,” says David Bell, vice president of application engineering.

**Conditional benefits**

Vendors offer tools, but none of them are as important to an organization as the up-front study of its own assets, models of its own work flows, and understanding its operating environment. Along with greater uptime and asset performance, better control of processes can reclaim lost dollars in the form of reduced scrap, better-tuned loops (in process applications) and less variation in product quality.

PM activities often are reduced, but many organizations replace them with human input of the lion’s share of data. The greater efficiency improvement is by reducing unplanned work and, in turn, overtime labor, as well as spare parts inventory. Most importantly, critical failures can be prevented, preserving the business from costly or catastrophic results to its bottom line, operations or human safety.

By advancing CBM and the greater goals of integrated maintenance in the enterprise, Johnston says, “We can’t necessarily solve world hunger, but we can certainly help people solve a much bigger portion of their overall challenges.”

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Modern industrial centrifugal compressors represent an energy-efficient, effective compressed air supply. Advanced designs and manufacturing capabilities offer energy savings opportunities to those who understand how to select and install them. Their operating characteristics, which some might call "quirks," represent opportunities to the savvy plant professional.

In a recent compressed-air review at a large paper mill, we investigated six 500-hp, three-stage centrifugal compressors, all of same model by the same manufacturer and built at separate times during a 30-year interval. The operating curves for these units revealed differing specific power ratings and operating characteristics at 100% full load discharge pressure (Table 1). Much of this improvement in the later versions comes from machining to microns of tolerance instead of the mils used in the past. That capability frees engineers to follow visions that weren't practical a few years ago. Modern electronics, controls, main drivers, inlet guide vanes and the like contribute to overall improvements.

The improvements in similar-sized standard units offer almost a 15% improvement in specific power from 1970 to 2008, with an improvement in calculated effective turndown from 15% to 30% or more (Table 1). About 3% of this comes from improved motor efficiency. If the older motors have been rewound or just lost efficiency because of the condition of the breaker, line or insulation, the overall improvement in specific power might well be as high as 20% or more. Motor performance should be part of the overall evaluation. (Input kW = power to drive the centrifugal compressor's motors at rated flow/pressure.)

If you bought your centrifugal compressors in the 1970s through the 1990s, it's prudent to review the improvements that are available now. An factor to consider is the net reduction in electric energy costs that your operation will enjoy if you upgrade your hardware — the dollars can be significant.

Several years ago, a large bottling plant in the southeastern United States replaced its 1970-vintage high-pressure (100 psig) and low-pressure (55 psig) centrifugal compressors with units built in 2005. The resulting specific power improvement, along with a 25% increase in turndown ca-

**Efficiency evolution**

<table>
<thead>
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<th>Model Year</th>
<th>Specific power (scfm/input kW)</th>
<th>Capacity (scfm)</th>
<th>Power input (kW)</th>
<th>Turndown (%)</th>
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</table>

Table 1. The improvements in similar-sized standard units offer almost a 15% improvement in specific power from 1970 to 2008 with an accompanying improvement in calculated effective turndown from 15% to 30% or more. About 3% of this comes from basic improvements in standard motor efficiency. If the older motors have been rewound or even have just lost efficiency because of the condition of the breaker, line or insulation, the overall improvement in specific power might well be as high as 20% or more. Motor performance should be part of the overall evaluation. (Input kW = power to drive the centrifugal compressor's motors at rated flow/pressure.)

By Hank van Ormer
pability, yielded a $600,000-per-year energy cost savings ($0.05 kWh, 8,760 hrs per year). The new units cost $600,000 and the installed cost was $1.2 million, which meant there was a two-year simple payback. Utility incentives further reduced the payback period. This was a project spawned from a comprehensive, full-plant compressed air audit.

**Turndown and electrical energy**

The industrial centrifugal compressor is a dynamic unit with a rapidly rotating impeller to accelerate airflow (Figure 1), which then passes through a diffuser that converts velocity head into pressure head. In the dynamic, mass-flow compressor, the power needed is a function of the air’s weight, flow, volume, temperature and head.

The impeller’s design and speed establishes the energy imparted to a pound of air passing through the impeller. That energy is independent of inlet variables. A centrifugal compressor, therefore, delivers a pound of air with a constant expenditure of energy, winter or summer. The volume of air compressed varies with the inlet pressure and temperature.

If more air is produced than is needed, the centrifugal compressor must unload (deliver less air) to avoid overpressure. A centrifugal compressor has a maximum pressure it can achieve under specific inlet conditions before the air flow reverses and surges, which triggers a protective compressor shutdown. This description of surge is oversimplified; however, each unit has a rise-to-surge limit or maximum pressure. Turndown is the fraction of full-load flow the compressor can handle without surging. For example, 15% turndown means the unit must run at no less than 85% capacity flow to avoid surging.

The surge point varies with inlet conditions (Figure 2). Air density increases at colder temperatures and higher inlet pressure, reducing the volume of inlet air that reaches the maximum mass flow rate. To hold a constant discharge pressure, the inlet air flow must decrease to avoid “running out on the curve” too far and reaching the area of potentially unstable operation. The opposite occurs at higher temperature and lower inlet air pressure. The centrifugal compressor can respond to a varying demand efficiently only within its turndown range. Beyond full turndown, the unit either delivers less air with no reduction in power consumption, or the inlet valve closes partially and operates with blow-off or recirculation at a 25% to 35% power draw with no flow to the plant. Such capacity control is storage-dependent.

Turndown is another area where modern units are superior to older ones. The greater the turndown, the more flexible the unit is in meeting demand profiles efficiently. Achieving a turndown of 25% or more in an older unit usually requires impellers designed for higher pressure and sacrificing lower-pressure operating efficiency. Although true, in reality, the efficiency difference is much lower. We now have as much as 37% turndown at 5.86 scfm/kW – a solid situation.

Modern inlet guide vanes are much improved over older versions, and are relatively easy and economical to retrofit to most existing units. Guide vanes don’t increase turndown, but they allow the unit to operate throughout the turndown range at or near full-load efficiency.

The data in Table 2 are drawn from a 2,500 cfm-class, 125-psig, three-stage compressor operating in the Midwestern part of the United States and show calculated per-

### Table 2

<table>
<thead>
<tr>
<th></th>
<th>Average Winter</th>
<th>Extreme Winter</th>
<th>Average Summer</th>
<th>Extreme Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. icfm</td>
<td>2,810</td>
<td>2,830</td>
<td>2,805</td>
<td>2,810</td>
</tr>
<tr>
<td>Max. scfm</td>
<td>2,871</td>
<td>3,224</td>
<td>2,612</td>
<td>2,422</td>
</tr>
<tr>
<td>Min. icfm</td>
<td>1,695</td>
<td>1,504</td>
<td>1,844</td>
<td>2,004</td>
</tr>
<tr>
<td>Max. scfm</td>
<td>1,729/TD 41%</td>
<td>1,711/TD 47%</td>
<td>1,715/TD 34.3%</td>
<td>1,726/TD 29%</td>
</tr>
<tr>
<td>Max. BHP (at full load scfm)</td>
<td>638</td>
<td>680</td>
<td>600</td>
<td>573</td>
</tr>
</tbody>
</table>

These are the effects of inlet temperature and ambient condition on performance and turndown for a specific three-stage centrifugal 2,500 scfm-class compressor at 125 psig.
formance and turndown limits at various times of year. The scfm rating reflects the relative air density and several other factors to establish limitations:

- Effects of ambient temperature and pressure
- Mass flow rate that avoids overloading the motor
- Cooling water temperatures
- Limited maximum volumetric flow rate

With these thoughts in mind, it’s obvious that an effective capacity-control system needs accurate data regarding inlet conditions, power draw and operating temperatures to optimize turndown. This, in conjunction with inlet guide vanes, allows the widest range of operation at or near full-load efficiency. Also, the air-management system should keep the units within their turndown ranges, except one that might be in blow-off. There are some effective centrifugal compressor central air-management systems that do this well.

**Other efficiency improvements**

Select an electric motor that’s large enough to handle the maximum expected flow at the cold conditions. A system designed for the southeastern United States used four 500-hp-class, three-stage units with 700-hp motors and an effective central air-management system. During cooler weather, we ran only three units. During the hottest months, we needed four most of the time. As a matter of interest, we used heat of compression desiccant regenerative dryers and held the velocity in the interconnecting piping to less than 20 fps, both of which resulted in using significantly less electrical energy for desiccant-dried air.

Run the centrifugal compressor at the lowest pressure while avoiding surge. This can increase the flow at, or nearly at, the same horsepower draw. The magnitude of the increase depends on individual unit performance curves. One unit we audited delivered 1,884 acfm at 453 bhp at 135 psig. At 90 psig, it delivered 2,074 acfm at 453 bhp – an increase of 190 acfm using the same power. This unit has a relatively steep operating curve; another unit might exhibit a much greater flow differential. You might need to modify the piping and ancillary air-treatment equipment.

Upgrade your existing units. Many original equipment manufacturers and some aftermarket organizations offer performance-upgrade packages for older units. In one case, a completely new high-performance compressor package can be set on the old drive train, in effect delivering a new unit at lower cost.

Add new technology. The centrifugal compressor lends itself to significant advances from technology, particularly with electronic controls. The electronic controls continue to improve performance with electronic devices that can cycle in milliseconds.

A new variable-speed drive uses a high-speed drive combined with uses asynchronous induction motors with magnetic bearings that can operate as fast as 60,000 rpm. This drive system eliminates the need for a speed-increasing gear box. The magnetic bearing provides the motor and direct-driven compressor assembly with stable control throughout the operating range. The shaft is supported by a magnetic field resulting in no contact and no wear.

This technology offers up-front advantages:

- No oil anywhere in the drive train
- No startup air required to hold oil back from the compression chamber when a double labyrinth seal is used
- Normal drive train mechanical losses are reduced from between 12% and 17% to between 6% and 9%
- The current lineup is two-stage units that are about 4% to 6% less power-efficient than a comparable three-stage unit. This is more than offset by the savings in mechanical losses.
Compressors can use the so-called “new impeller design” with good efficiency well below the first critical speed. Most conventional units go carefully past the first critical speed and try to operate below the second or between the second and third.

Capacity control is achieved with a microprocessor-controlled variable-speed drive. When the demand for air falls and the pressure starts to rise, the drive speed reduces proportionally down to about 25% (or the calculated actual turndown range). If the pressure continues to rise and crosses the adjustable maximum pressure point (usually 10 psid), the unit then goes to no load.

The speed falls to idle and the energy draw falls to 2.5% (compared to 25% to 35% or more for conventional units). When the pressure falls to the preset “load in pressure,” the compressor immediately goes to full flow. Every time the unit goes through this cycle, it calculates the actual surge point and adjusts the control accordingly to optimize the turndown capability. Unlimited starts and stops each hour allows significant operating efficiencies. Obtaining the full benefits of this capacity-control system, like every other, requires a minimum volume of effective storage. Depending on the size of the dead band, average flow and piping configuration, this probably will range between 3 gal. and 5 gal. of effective storage per cfm of flow. Effective storage includes all air receivers, equipment and piping inside the dead band range (unload pressure/load pressure). Unlike a positive displacement compressor, there’s no extra energy required to produce the dead band. Running the centrifugal compressor at a higher pressure means lower flow at about the same horsepower. Obviously, if we’re unloading, we don’t need the extra flow. As presented, this new technology promises a two-stage, oil-free compressor with overall full-load efficiencies equal to most similarly sized three-stage centrifugals and is somewhat better than many two-stage, oil-free rotary screw compressors.

The controls allow an effective load/no-load (two-step) operation with a low idle input power of 2.5%. The electronic microprocessor continues to recalculate the actual turndown capability and use it appropriately. There’s a lot going on in the centrifugal air compressor world. Product and performance improvements are constant. Take a good look at your existing units. A full review or compressed air audit might identify real opportunities for improvement.

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Unfavorable market conditions have shut down many plants temporarily. Others have regularly scheduled shutdowns during the year. Maintenance departments frequently take advantage of these opportunities to repair or perform testing that can't be done when hydraulic machinery is operating. But given the lull in the action, many times the only attention a hydraulic system gets is an oil and filter change. If those are the only two tasks on your work order, they won't necessarily increase reliability. You'll need to perform several other checks and procedures during down periods to boost the odds of gaining system efficiency and operation when production demands are high. The following preventive maintenance checks will reveal other maintenance work that will improve system and machine performance.

Clean the reservoir
Now is an ideal time to clean the reservoir (Figure 1). Maintenance mechanics and electricians chuckle when I tell them that the reservoir should be cleaned at least once a year. While consulting with a large wood products plant, the mechanic said that the reservoir on one system hadn't been cleaned since the mill started up 17 years before. Beyond oil storage, the two main purposes of the reservoir are to allow contaminants to settle and to dissipate heat. If the reservoir isn't cleaned, it'll act as a heat sink and can cause the system temperature to rise above 140°F, the point at which oil starts breaking down, adding sludge and varnish to the system. If the contaminants aren't removed...
from the reservoir, they’ll be drawn into the pump and cause premature failure of the system components. And, of course, be sure to use lint-free cloths when cleaning out the reservoir.

**Clean and flush**

When you clean the sump, you don’t necessarily need to replace the hydraulic fluid. Unless the oil is severely degraded, all you need to do is run it through a 1-micron filter into a storage tank to remove solid contaminants and water. Then, run the oil through a clean 1-micron filter when refilling the sump.

**Depending on the location, the breather cap might need to be changed a couple of times per year.**

The next step is flushing the lines to the valves and actuators with clean oil. Figure 2 shows the flushing unit we use for this process. Connect the inlet and outlet lines of the cylinders and motors together. If possible, electrically or manually actuate the directional valves to allow the fluid to circulate through the piping. If this isn’t possible, bypass the directional valves by connecting the pressure and tank lines to the actuator’s outlet lines. Use the pump on the machine to circulate the oil through the lines. Connect the flushing unit so it circulates the oil in the reservoir through 1-micron filters. Allow the system to run for as long as possible. Figure 3 shows the purity of the oil for a system before it was flushed, then after one, four and 16 hours of flushing.

**Other reservoir tasks**

An important variable is the reservoir heater setting. Check the reservoir heater thermostat (item 2 in Figure 1) to verify that it toggles on at a minimum temperature of 70°F. A pump mounted on top of the reservoir can cavitate if the oil temperature drops below about 60°F.

Insufficient oil depth can cause problems, so most reservoirs feature two switch settings (item 7 in Figure 1) – a warning and a shutdown. The problem with this configuration is that the difference between the two levels might represent several hundred gallons of oil. Eliminating the warning switch and setting the shutdown at a higher level minimizes the oil loss should a hose rupture.

Next, verify that the breather cap (item 8 in Figure 1) has a rating of about 10 microns. This is the first line of defense against airborne contaminants entering the tank. Depending on the location, the breather cap might need to be changed a couple of times per year. Other options include pressurizing the reservoir with an internal blader or using a moisture-removal-type breather.

High temperature can undo your efforts. Oil starts breaking down at 140°F, but many systems won’t initiate system shutdown until the oil temperature reaches 160°F. If your hydraulic system is operating above 140°F, there’s a problem in the system that might be traced to a cooler malfunction or excessive bypassing at the pump, valves, cylinders and hydraulic motors. Set your high-temperature switch (item 10 in Figure 1) at 140°F to shut the pump off and prevent oil breakdown.
Now for the system

Heat exchangers need flushing and cleaning. Flush the tubes in a water-type cooler (item 12 in Figure 1) periodically to remove deposits. A mild alkaline solution such as Oakite or a 1.5% solution of sodium hydroxide or nitric acid can be used. If your system uses an air cooler, verify that the fan turns on when the oil temperature reaches about 118°F. Use combs to straighten the fins on the unit if necessary.

Don’t forget pump testing. If you use a variable-volume pump, check the flow out of the case drain line by porting it into a container and using a stopwatch to measure the flow. Make this test with the outlet pressure at maximum. Don’t risk safety by holding the line by hand during this test. Instead, secure it to the container before starting the pump. The normal case flow is 1% to 5% of the maximum pump volume. Vane pumps usually bypass more than piston pumps. If 10% of the maximum volume flows out of the case drain line, replace the pump.

Test fixed-displacement pumps by checking the flow through the relief valve. Turn the pump on and measure the flow rate coming from the relief valve tank line for one minute (Figure 4). Then reduce the relief valve setting to its minimum. There should be less than 10% difference in flow rates between the two tests. If a pump is badly worn, the flow will be considerably less at the highest pressure.

Test accumulators if your hydraulic system uses piston accumulators, install the charging rig and bleed the oil off the top of the piston (Figure 5). With the pump on and the bleed valve open, there should be little or no flow exiting the bleed valve. If the flow is continuous, the piston seals or barrel are badly worn. If the flow ceases, recharge the accumulator to the proper pressure using dry nitrogen.

Test bladder-type accumulators by installing the charging rig on the valve stem. Osmotic pressure forces dry nitrogen through the bladder over a long period of time. If necessary, precharge to the recommended pressure.
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Look for worn hoses

Check the hoses in the system for the proper length and signs of wear. It’s rare for a hose to burst because the rated working pressure was exceeded. Normally, hoses rupture because of a poor crimp or from rubbing on a beam, another hose or some other object.

If rubbing can’t be avoided, invest in a reel of hose sleeves, which are available from a variety of manufacturers. A hose should not exceed about 4 ft. in length, unless it moves with a machine member. Also, inspect system piping to verify that a hose is included where you connect to a valve bank or cylinder. The hose absorbs the hydraulic shock generated when oil is rapidly deadheaded.

An exception to this rule is that you should use only hard piping when connecting to a vertical or suspended load. Pilot-operated check valves and counterbalance valves are used to hold the load in the raised position.

Clamp correctly

Verify that pipes that are mounted to structural elements are made using proper hydraulic clamps. Ordinary beam and conduit clamps aren’t acceptable, because they can’t absorb the shock generated in the piping or tubing. Space the clamps about 5 ft. apart along the run and within 6 in. of the pipe or tubing terminations.

Once the system is thoroughly inspected and upgraded, develop a preventive maintenance schedule to make these checks on a regular basis. Many times, no thought is given to the hydraulic system as long as it’s running and the machine is operating. By performing the checks listed here, your systems will operate at maximum efficiency, operate more safely and reduce downtime.

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The word quality often is misunderstood by many people, regardless of profession, education, geographical location or marketplace. This includes the industrial marketplace as it relates to plant floor problems.

The question of quality is best approached using some of the common definitions that literature on this subject has offered. As referenced in Wikipedia, the most progressive view of quality is defined entirely by the end user’s evaluation of the entire customer experience. That’s the aggregate of touch points customers have with a company’s product and services, and is, by definition, a combination of these.

Another question is how to achieve it. Flooring product manufacturers achieve quality by adherence to a standard such as ISO 9001:2000. The International Organization for Standardization developed it so companies can compete in a global marketplace using identical quality requirements. Manufacturers should seek a quality-management system (QMS) certified to the ISO 9001:2000 standard. They do this to better fulfill customers’ quality requirements and meet applicable regulatory requirements, while enhancing customer satisfaction and achieving continuous improvement of its performance in pursuit of these objectives.

On the plant floor
The ISO 9001 standard is of significant help in applying a quality approach to an existing floor problem. Specify 9001 or a similar quality standard when choosing companies that will be addressing your flooring problem. They should show demonstrable proof that they’re focused on the standard, not just on some glib, loosely defined definition of quality.

Understand exactly whose customer you are. End users often rely on contractors to resolve problems and might unknowingly remove themselves from the manufacturer’s customer-satisfaction process. Contractors lacking a QMS might be unable to provide a quality approach to problems when the manufacturer isn’t directly involved in the project.

Manufacturers with an established QMS shepherd end users through a quality process that helps them recognize, dissect, prioritize and identify the actual floor problem. These manufacturers typically provide a trained installer and follow-up to verify installation effectiveness. Manufacturers have the in-depth knowledge of the problem identification and root-cause analysis process that comes from training and experience in meeting their QMS requirements. Your supplier’s purpose in using a quality approach is to help you address problem causes and potential problems while removing knee-jerk reactions and unjustified assumptions.

A quality approach (also known as “Corrective and Preventive Action” in the ISO standard), typically involves seven steps you should be looking for and be able to identify:
1. Problem identification
2. Immediate action
3. Interim action
4. Root cause identification
5. Solution implementation
6. Follow-up verification
7. Preventive action

Problem identification
The manufacturer should help you prioritize floor problems, which are multidimensional and based on certain criteria:

- **Impact:** The seriousness of the current situation – its effect on your goals.
- **Urgency:** Health or safety threats; deadlines (legal, regulatory, contractual); complaints, returns, reputation or market share; costs (corrections, adjustments, rework).
- **Trends:** The consequence of leaving it alone – probability of remaining stable, getting worse or becoming recurrent.

Some floor problems occur during design and construction where chemical and physical abuses often are overlooked. A few years later, the following problems of an unprotected or insufficiently protected concrete floor might then arise:

- **Physical destruction:** Impact from falling drums, power trucking, wheeled traffic, heavy loads, fork lifts.
- **Chemical attack:** Spillage, bacterial build-up, leakage, penetration and thermal shock.
- **Worker safety:** Unevenness (defects, holes, depressions) and slippery surfaces (hot oil, grease, continuously wet).
• Environmental: Pollution leaching through concrete.
• Compliance issues
• Loss of work time

Immediate action
Also known as the Band-Aid approach, immediate action isn’t necessarily applicable to every problem. It might include shutting down an area to maintain worker safety or product quality until the root cause can be identified, or it might require shutting down production altogether.

Interim action
Take temporary measure(s) until the problem cause can be solved, such as installing metal floor plates to cover damaged areas; eliminating potential health, safety and welfare hazards; or repairing the floor with a concrete repair kit until you can implement a long-lasting solution.

Root cause identification
Discover what can be changed to make the problem go away forever. It’s the most critical step. If your supplier gets it wrong, the solution will most likely be wrong.

The quality approach to decision-making saves you time and aggravation, and precludes the quick result that leads to preconceived solutions based on assumptions instead of facts. Perfect planning and execution can’t make up for a wrong initial decision. An thoughtful root cause analysis eliminates jumping to conclusions, wild speculation, more possibilities than probabilities and inefficient investigation.

Your product supplier needs to coordinate your problem-solving team to better analyze the floor problem root cause. A typical team includes the product supplier, along with top management in your organization. This includes an operations supervisor who has knowledge of practices and the authority to direct the workforce, along with a manufacturing engineer with knowledge of facility equipment and authority to modify tooling and work methods. Lastly, another important member of this team is a trained installer, recommended by the manufacturer, who has extensive knowledge of the product being applied and years of application experience.

It’s also a good idea to include an independent quality engineer who has the inspection and testing knowledge and expertise for proper substrate analysis. In the absence of such an engineer, the installer should perform the testing and inspections and, therefore, should have the expertise and knowledge to use the most current test standards, such as the American Society for Testing and Materials (ASTM) standards, the standards of choice for a diverse range of industries.

Among the many considerations to address during a root cause discovery are substrate properties – concrete, tile, wood, steel, bituminous covering or an old coating system that needs to be replaced. The substrate’s properties and its treatment are highly dependent on the nature of the substrate. For example, compressive strength of a concrete floor determines how it supports shocks and impacts that can delaminate the flooring.

Another consideration is the substrate moisture level. Most flooring systems have low vapor permeability and act as a barrier to moisture. Vapor pressure buildup often destroys the surface treatment. Calcium chloride testing reveals the presence of moisture emissions in the slab, as well as osmotic groundwater pressure. If moisture can’t be prevented, you’ll need a vapor-permeable system.

The substrate’s current environmental exposure and usage are relevant to effective root cause research. Analysis might include inspection and testing for dirt, oil or chemical contamination; concrete defects and damage; ground movement or settling; structural or substrate failure; oil or hydraulic fluid penetration, or form-release agents in concrete; alkaline silicate reaction (ASR), which causes cracking and expansion in concrete slabs; and improper design or construction of the substrate on which materials are applied. No test can reveal everything that should be considered deciding about floor coating or resurfacing system installation. Test results only provide a snapshot of the slab condition at a particular time.

Solution implementation
After completing a successful problem diagnosis, the manufacturer must decide on a product and its application to
After identifying the root cause of the problem and specifying the solution, focus on proper surface preparation. It must be sound, dry and clean before applying any product to ensure optimum substrate adhesion. The preparation methods depend on the type of floor coating or resurfacing system being applied. Choices include:

- **Vacuum shot blasting**: The most popular method, it’s 98% dust-free, thus environmentally friendly.
- **Scarification**: Aggressive, for severely eroded floors.
- **Milling**: Removes badly damaged concrete.
- **Grinding**: Removes the skin of a fresh concrete substrate or old paint layers.
- **Chemical preparation**: Typically, acid etching.

The function and resistance of a floor coating provides a variety of solutions depending on the resistance required. Take into account the floor coating properties once the substrate and usage have been analyzed and documented.

An important floor coating property is its abrasion resistance. Generally accepted classifications for usage are:

- **Light traffic**: Pedestrian and hand truck usage.
- **Medium traffic**: Fork-lift trucks, wooden pallets, crates.
- **Heavy traffic**: Wheeled machinery and equipment, heavy-duty fork-lift trucks and metal pallets, crates.

Another important property is chemical resistance. Industrial floors can be subject to chemical attack from acids, oxidizers, alkalis, salts, organic compounds, dyes, solvents of all sorts, fuels, oils and greases.

The manufacturer should encourage you to consider the future (short-term versus long-term occupancy, lease or own, changing conditions, crucial factors overlooked, spin-off effects and side-effects).

Once the product and application are defined, the manufacturer should furnish a Material Specification Guideline to document the project scope, current floor conditions, problem diagnosis, the root cause and the solution that prevents recurrence. All too often, after the floor resurfacing system is installed, end users forget the product name and the company that installed it. Look for a manufacturer that remains with you throughout the project. You want one that partners with you to provide ongoing support and technical assistance that maintains the condition of your flooring and prevents potential problems in the future.

**Follow-up verification**

The manufacturer should follow up after project completion to verify its effectiveness and to ensure the result meets your needs and satisfaction. All too often, after the floor resurfacing system is installed, end users forget the product name and the company that installed it. Look for a manufacturer that remains with you throughout the project. You want one that partners with you to provide ongoing support and technical assistance that maintains the condition of your flooring and prevents potential problems in the future.
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Preventive action

This ongoing support program addresses the final piece of the “Corrective and Preventive Action” process. Thought must be given to preventive actions that help remove the causes of potential floor problems to prevent their occurrence. Preventive actions must be appropriate for the effects of the potential floor problems and should be relevant to the performance of your industrial floor. Some typical data sources used during discovery might come from the results of your facility’s problem diagnosis considerations, industry analysis, lessons learned from past experience, results of self-assessments and daily operational use.

Consider applying a protective floor coating or resurfacing system in the absence of an existing problem because concrete, by nature, is always in a state of deterioration unless it’s protected from environmental conditions. Eventually, an unprotected or insufficiently protected substrate can break down from exposure to its environment, its usage or from passage of time.

The manufacturer’s support program might provide you with suggestions about preventive actions, such as protection against wear and damage; protection against chemical deterioration; reduction of maintenance and cleaning costs; cleaner work environment (limited dust release from wear); decreasing injury rate from slips, trips and falls; prevention of static charges using conductive coatings and more efficient workflow using directional markings. Awareness of these possibilities can help you discover opportunities for improvement in protecting and maintaining your facility floor.

The issue of quality, as it pertains to a QMS standard, involves thoughtful analysis on the part of the manufacturer from the initial diagnosis of your floor problem all the way through solution implementation and follow-up, which ultimately results in fulfillment of your requirements.

Often we find that the term “quality” is used rather loosely, so the next time you hear a manufacturer or contractor use this term to identify itself as “top quality” in providing products and service, you’re armed with the knowledge to put them to the test. And remember, quality is as you define it. You have every right and expectation as the customer to achieve your desired outcome.

Tara W. Crowley is a RAB-certified QMS Lead Auditor for Garon Products Inc. in Wall, N.J. E-mail her at twcrowley@garonproducts.com.
I’d be willing to bet that if you scanned your environment right now and pondered the state of your company, you’d be able to provide several splendid examples of less-than-stellar decisions some of your contemporaries have managed to inflict on the entire organization. Sometimes the reasons for having done so are quite obvious, sometimes not.

What is certain, though, is that as the number of input variables affecting the final decision increases much beyond two or three, the human brain loses its ability to justify calling ourselves *homo sapiens*. In the real world, the amount of data to be evaluated can be overwhelming. Perhaps the data are valid, but even so, it’s probably incomplete, messy and appears to differ little from a series of random numbers or facts. There must be a way to make sense of that hash in the industrial world.

It can be done. You’ve heard of the electronic trading systems used in the financial markets. Skilled traders systematically reduce their experience and intuition to a set of rules that a computer executes to return clear, unambiguous buy and sell signals much faster than a human can. Sometimes the computer itself initiates the trades. It’s the closest thing we’ve got to a money machine.

Join me for a leap into that digital morass we call the Web in search of practical, zero-cost, noncommercial, registration-free resources that ought to help you when you’re “the decider.” Remember, we search the Web so you don’t have to.

An easy read

So, what exactly do we mean by the term decision support system (DSS)? You can bet it involves a computer. Beyond that, it would be better to pay a visit to academia and talk to the experts. In this case, I’d suggest you contact Marek J. Druzdzel and Roger R. Flynn from the Decision Systems Laboratory at the School of Information Sciences and Intelligent Systems Program at the University of Pittsburgh.

I hesitate to refer to them as prototypical ivory-tower types because they’ve written a 15-page paper titled “Decision support systems” that avoids any use of the abstract, esoteric and abstruse, which should make it perfectly comprehensible to anyone reading this column.

The paper explains the characteristics of decision problems and how computer programs can support decision making. It goes on to detail the various DSS components and the role they play in decision support. The authors introduce an emergent class of something called normative systems and decision-analytic DSS.

Finally, they review issues related to DSS user interfaces and the importance they have to the quality of any computer-assisted decision. You might as well decide to wander over to www.pitt.edu/~druzdzel/psfiles/dss.pdf and spend quality time with the document. It will be worth it.

Funding medicine

You no doubt have heard the old joke about the guy who goes to the optometrist for a new set of spectacles and, naturally, asks about price.

The optometrist tells him it will be $75. When the stunned guy hesitates, the optometrist quickly adds, “per lens.” When the guy, now in shock, still doesn’t respond, the optometrist says, “plus frames.”

Capitalism is all about negotiating for the best price you can get, and researchers in the medical profession know how to exploit a DSS to maximize returns for practitioners.

If you think this is a joke, the next Web article citation is titled “Willingness-to-pay utility assessment: feasibility of use in normative patient decision support systems,” by Flowers, Garber, Bergen and Lenert, all from the Stanford University School of Medicine.

The link (www.ncbi.nlm.nih.gov/pubmed/9357621) takes you to an abstract of the article. That’s the best I could do. I found it impossible to finesse the digital morass to access the full text at any of the sites that mention the piece. The bottom line: You probably should be circumspect when talking to anyone in the medical field.
Another application

Come the fall, football season will be in full bloom, along with adjunct activities such as office pools and fantasy football leagues. Needless to say, if you’re going to put real cash into these ventures, you might want to consider the idea of using a DSS to slew the odds a bit more in your favor. One such single-purpose DSS is available, amazingly enough, on the Internet. Brandie Searle and Greg Alan developed the software and Automation Creations Inc., out of Blacksburg, Va., distributes it online. Although the software is free, you’ll need to subscribe if you want periodic data updates. I’d imagine that those who are sufficiently rabid about football will probably be able to wing it without the updates. That’s a personal choice you can make when you do an end run to www.pcdrafter.com to start betting smarter.

Organically grown

The financial markets in this country are said to be efficient. That means arbitrage, or buying a negotiable instrument at a low price in one market and selling at a high price in another, is nearly impossible, instant communication being what it is. Everything relevant that’s known about the stock or bond or whatever is already reflected in the price. Besides, there are thousands of people working on calculations and theories designed to beat the market. They’re all nibbling at the edges, never getting a big bite, and market prices reflect the truth about value.

The collective action of so many players, a prediction market, constitutes a decision support system that indicates how much one should pay for a particular investment. But that’s not the only use for a prediction market. They’ve been applied to the Fed’s monetary policy, economic indicators, stock prices and more. They’re a sort of futures market that uses real money and has real payoffs; anyone can play, but it’s a winner-take-all game. If you’re interested in the power of prediction markets as a viable DSS, you should read “Prediction Markets as Decision Support Systems,” by Joyce E. Berg and Thomas A. Rietz at the Henry B. Tippie College of Business at the University of Iowa. This 15-page paper, available at managers. A mere mouse click gives you a DSS FAQ and a selection of case studies. The other options require registration and cash. So, go to http://dssresources.com, but tread lightly. Generic multi-attribute analysis (GMAA) is a type of DSS that tolerates incomplete input data. Lacking sufficient space to explain it in any more detail, I’ll refer you to www.dia.fi.upm.es/~ajimenez/GMAA, where you can learn more about it at www.biz.uiowa.edu/iem. Political junkies can now put their money where their mouths are.

A DSS is almost mandatory if one is to make sense of the gigabytes of CMMS data.

Hyperspatial data

Sometimes the data that fill a DSS can only be represented by a series of complicated, interdependent tables. If you have only one or two relevant variables, you could use a flat sheet. With three variables, your spreadsheet morphs into a cube, which a spreadsheet could still conceivably handle. If you have four or more variables, you’re into hyperspace and analysis in that realm is going to require another approach. This is a good time to introduce the idea of OLAP, an acronym for online analytical processing, the software that proves useful for any multidimensional set of DSS data. There are several sources for OLAP software. In a completely capricious, arbitrary, random selection, I present for your consideration the www.filedudes.com. Pay them a visit and enter the term OLAP in the search box. Then, scroll down for an entry called OLAP + CHART MODELKIT 3.6 by Perpetuum Software. At that point, you can access a free download as long as you’re satisfied with a trial version.

A good collection

Decision Support Systems Resources is an evolving Web site that’s intended to be a repository of cutting-edge information about the topic. Launched during the summer of 1995 by Daniel J. Power, a professor of Information Systems and Management at the College of Business Administration at the University of Northern Iowa, Cedar Falls, the site has some good features. The important links are on the left side of the screen. For example, the folks engaged in designing and using decision support systems have, as you would expect, developed a certain jargon to better communicate their ideas. The “DSS glossary” link can have you speaking fluent DSS quickly. If you need to do a literature search to enhance your argumentative credibility vis-à-vis management, the “Articles” link gives you access to many free documents gathered from a variety of sources. One “channel” is direct-
Madrid have made it possible for you to download, for academic purposes only, a free copy of GMAA, the software that makes the analysis possible. This is no lightweight application; the user’s manual has 83 pages and you’ll have to spend some time digesting the content. One never knows; it might solve the maintenance crisis.

**Closer to home**

The purpose of this column is to convince you that decision support systems can be applied to activities in the industrial maintenance arena. A DSS is almost mandatory if one is to make sense of the gigabytes of CMMS data that describe the current and historical condition of the countless operating assets used in a multiplant operation. Making rational decisions when you’re drowning in data isn’t the easiest part of the day. Daniel J. Fonseca in the Department of Industrial Engineering, University of Alabama in Tuscaloosa, feels your pain. To demonstrate the practicality of DSS-enhanced maintenance, Fonseca developed a fuzzy expert system that supports reliability-centered maintenance (RCM) programs during the design of industrial chemical processes.

You should read about his project in “Reliability Management Through Knowledge-Based Systems,” which is posted at http://ie.eng.ua.edu/research/MRC/Reliability_Thr_Kn-Bsys.doc. Among other things, he cites four maintenance applications in which decision support systems have already been successful: overland communication cables, nuclear power plants, hydraulic power systems and optimizing maintenance routines. So, you see, it can and has been done. You can do it, too. While you’re there, consider “A decision support system for machine replacement policies” that Fonseca wrote with two colleagues, Shital Shah and G. P. Moynihan. This one is at http://ie.eng.ua.edu/research/MRC/DSS_RE PLACE_POLIC.doc.

**Without comment**

http://en.wikipedia.org/wiki/Decision_support_system
http://damascas.sourceforge.net

E-mail Executive Editor Russ Kratowicz, P.E., CMRP, at russk@putman.net.
Acme's corporate culture revered a well-entrenched policy of filling vacant positions with the most qualified applicant. The thinking was that the company gets the absolute best help money can buy.

Joe Hannusberg worked for Acme in its distribution center, essentially a warehouse, where he walked the aisles filling orders by picking items from bins to load something akin to a shopping cart. Most of the items detailed on Joe's pick list were relatively small, which could be grabbed one-handed while walking past the bin. Others, however, are definitely “two-handers” because they weighed as much as 25 pounds.

Last Memorial Day, at a city-wide picnic, Joe was sitting just behind the baseline at a pickup baseball game. The crack of a bat resulted in a cracked and broken bat, the loose, raw, broken end of which arced into the stands and impaled his left arm. The resultant nerve damage rendered his arm permanently disabled and, for all practical purposes, functionally useless.

After his rehab, Joe returned to find that the injury made performing the duties of order filler impossible. It wasn't a problem to pick small parts with one good hand. But, Joe dropped a few larger items, one of which broke upon impact. Embarrassed, he faced the fact that continuing in this job was out of the question. From that point forward, Joe took extra care, which slowed his pick rate quite a bit.

After coming to terms with the disability, Joe requested a transfer to an equivalent vacant position at Acme. At the time, there was an open slot for a router, and an office job, the main tools of which were a computer and mouse. The router position had already been vacant for a few months. Ellie Fantiere, Joe's supervisor, urged him to apply because she felt that Joe was perfectly qualified for that job and she knew that Acme realized that it needed to fill the vacancy soon. Ellie convinced Joe that it was a position in which a person of limited dexterity could excel.

The job paid only slightly less than what order fillers were being paid.

Joe applied for the job, but Acme didn't immediately assign him to fill the slot. The explanation was that the company hadn't yet gone through the vetting process to select the best candidate. As a result, Joe was obliged to put his name in the hat along with others, both current employees and outside candidates, who had already applied for the position.

Joe interviewed the candidates for the router position during the next two weeks. Later, Joe received a letter from Acme's HR department that said although Acme felt he was qualified for the position, the company selected an able-bodied, non-disabled person. The letter also reassigned Joe to a position as an associate in the janitorial department, which paid about half of what he earned as an order filler. Joe had no other viable option and accepted the transfer.

He struggled with his new duties as best he could, but also filed a lawsuit, arguing that giving him the router job would have been the ideal, reasonable accommodation expected of every employer. By doing otherwise, Acme has proven that it discriminates against the handicapped. Acme argued that there's not a trace of discriminatory practice in the long-lived corporate practice of filling an open position with the best-qualified person. As a consequence, Acme said it had no obligation to assign Joe to the router position.

How could this situation have been avoided? Can "best qualified" trump accommodation? Is it discriminatory to select only the best candidates? Is it sufficient accommodation merely to allow a handicapped employee to compete for a job? Is it discriminatory to give a person a job based only on membership in a protected group? Is the janitorial position worth the pay “a reasonable accommodation”? Is there another way that Acme could have worked with Joe to find him a position within the company with pay comparable to his previous order-picker position? What do Acme’s actions say about the company’s loyalty to its employees?

An attorney says:

Acme might have had an obligation to assign Joe to the router position if he could perform its essential func-
tions using only one hand. Under federal law, the Americans with Disabilities Act (ADA), Acme must reasonably accommodate a disabled employee unless it poses an undue hardship.

One way to reasonably accommodate a disabled employee is to transfer him to an open position for which he is qualified. “Qualified,” in this sense, means that the employee has the skills, experience and education to perform the job and can perform the essential functions with or without reasonable accommodation. The Equal Employment Opportunity Commission (EEOC), which enforces the ADA, says the employee doesn’t need to be the best-qualified for the position.

Regardless of the type of accommodation, Acme violated the ADA by failing to engage in an interactive dialogue with Joe about the ways in which he could be accommodated. Julie Badel, partner Epstein Becker & Green, P.C (312) 499-1418 jbadel@ebglaw.com

A corporate consultant says:
The humanitarian in me says that Acme handled this poorly. There’s no indication that Joe had been anything but a solid employee. He didn’t cause the accident by engaging in risky behavior. Acme could have worked with him to provide accommodation for his disability or to provide him with skills training for a different position.

Perhaps the long history of selecting only the best-qualified person should have given a preview of how accommodating Acme would be. I’m a firm believer in policy consistency – 98% of the time. Consistency allows the workforce to count on policies and procedures. This increases efficiency and effectiveness.

Beyond what the law says, sometimes an organization must do the right thing. Actions that might appear to be the best current decision can have negative consequences in a broader sense. What message does Acme send to its workforce by not working in Joe’s best interest? I’ve written earlier about the role of trust in an organization. It’s the key element that reduces conflict and increases teamwork; it’s what fosters the best work environments. Everything a supervisor does either builds or reduces trust. Acme acted in a manner that reduced trust.

It’s not necessarily discriminatory to select the best candidate. It’s discriminatory to craft a job description that eliminates qualified people because of physical or other challenges. I believe Joe has a basis for his lawsuit. We didn’t

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Everything a supervisor or manager does either builds trust or reduces trust.

Whether Joe can perform the job will determine who prevails in his lawsuit. This depends on whether two hands are required to use a computer and a mouse. Everyone knows a person can operate a keyboard with one hand, but it’s not an efficient way to work, and using only one hand takes twice as long as using two. Is it an essential function of the router job that the employee type at a certain speed? Can Joe type at that speed using only one hand? Can Joe type at all?

Another interesting question is whether Acme could have accommodated Joe in the order picker’s job by using other employees to pick the occasional heavier item, while allowing Joe to continue to pull those lightweight items that he could lift with his good arm. Whether this is a reasonable accommodation depends on how frequently heavier items need to be moved and how disruptive it would be for other employees to assist Joe.
IN THE TRENCHES

learn what the job description required, but his distribution center supervisor clearly believed him qualified. The response Joe received indicated that Acme felt his physical limitation was a factor in his not being selected; HR stated that he was qualified for the router position, but the company selected an able-bodied, non-disabled person to fill the position.

There are many ways that Joe could be accommodated. As suggested above, the company could provide a means for Joe to handle parts that weigh 25 pounds. This might be a cart with adjustable height. Perhaps skills training would qualify him for a less physical position. The janitorial position, which would arguably require equal or higher levels of physical effort, isn’t a reasonable accommodation. It’s also not reasonable to move him to such a job with physical demands at a much lower wage rate.

Acme should put its attorney on speed dial for this one.

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An academician says:

Joe doesn’t seem to be contesting that he’s not able to perform his picker job. The issue seems to be more of pay — he thought he deserved the router job at about the same pay, but instead was given a janitor job at half the picker’s pay.

The case illustrates the conflicts about the basis for deciding these issues. Certainly, one could argue Joe’s case from a moral position. After all, Joe is a loyal employee who, through no fault of his own, was permanently injured. Does not Acme have a moral obligation to take care of him by making sure he is kept at his current pay and benefits but with different responsibilities? Maybe even promote him to a picker supervisor, with a pay increase but no lifting?

Or they could have appointed him to the router position and ignored the standard Acme merit selection process. That would have satisfied their moral obligation to Joe.

When I give similar cases to my students, a goodly number of them argue from this position and say that Acme had a moral obligation to loyal Joe. And, certainly, many companies followed this approach. “Taking care of each other,” and “Taking care of our workers,” was the slogan.

However, this approach, together with guaranteed lifetime employment, has faded. Basic economics is one reason for the fade, but increasing legal restrictions produced problems because these policies were very loosely applied.

Moving to the legal approach, Acme is obliged to provide Joe with reasonable accommodations. This doesn’t mean, however, that Joe must be promoted, put into a custom position developed specifically for him, be given the same pay or be given priority over other applicants. Accommodation could mean a mechanical device to help with heavy lifting or finding a vacant slot that he’s qualified to handle.

Although there’s little reference to any attempts to assist Joe on the picker job, in my mind, Acme seems to have acted in compliance with its legal obligations to Joe (and to the rest of Acme employees who were told that assignments are based on merit).

Thus, here we have a clash between those who argue for a moral position and those who argue from the legal position. Certainly, other options would come to mind, for example, help Joe retrain to make him eligible for another job or another career. However, Acme isn’t obligated to do that, but it would be a nice way to show that they are taking care of their own.

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Rising energy prices are rarely greeted as harbingers of good news. In the United States, industry is feeling the crunch from energy budgets being blown out of the water. Energy managers are being challenged to find the “answer” to rising energy costs, a challenge that has neither a quick – nor an easy – solution. This unease is exacerbated by concerns about the effects of climate change legislation.

Maybe this uncomfortable picture has the seeds of good news in it. Energy is finally and unquestionably making it toward the top of the list of senior management’s concerns. This alone should have every energy manager cheering. For too long at most companies, energy productivity concerns have ranked just above the color of the lines in the parking lot. The energy manager’s role has suddenly become an exciting opportunity for personal growth and career development.

Justifying resources to reduce current energy costs and mitigate uncertainty has become a lot easier. The arithmetic is really simple. The returns on energy productivity projects increase linearly with increases in market prices, and become substantially more attractive as uncertainty grows. This challenges us to question conventional wisdom and take a look at choices that traditionally would have been rejected. Now, large-scale heat recovery, cogeneration, renewable energy and even fundamental redesign of manufacturing processes are on the table like never before.

Within companies, groups that had little or no communication are being challenged to work hand-in-hand to manage the economic, environmental and reliability effects of energy today and in the future. As multidisciplinary teams come together to manage one challenge, they inevitably find other areas where they can enhance the operation.

Traditionally industrialized countries have seen vast areas of their manufacturing base move east and south. We should pause and remember that this migration is really a continuation of a process that began at the start of the industrial revolution. As the steam-driven loom replaced the local weaver, and trains and canals moved products around Europe and America, traditional employment migrated from local workshops to the great manufacturing centers of Manchester, Essen and Pittsburgh. In effect, this process is continuing with the growth of manufacturing in China, India, Mexico and elsewhere.

Two centuries of manufacturing concentration and migration have been built on almost equal parts on labor cost, technical innovation and very cheap, freely available energy. Low-cost energy allowed goods to be moved within and between continents to economically serve distant markets. It also frequently disguised the inefficiencies inherent in many factories, and did little to encourage sustained improvement.

Rapidly rising energy costs are suddenly changing 200 years of assumptions. The cost benefit of distant manufacturing is being eroded in large part by the increases in transport costs. As energy prices rise, the competitive radius of the farm or factory shrinks. For countries and regions that have borne the brunt of rapid globalization, this can only been seen as a good thing. It’s likely that these regions, which clearly include large parts of the United States and Western Europe, are entering a phase of reindustrialization.

Now is the time for the strategic marketing teams to be analyzing the effects of energy costs on their strategic competitors and positioning new, efficient manufacturing to compete in a restructured world. In this world, the proximity of manufacturing to markets will again become a factor.

Ironically, it’s also the time to look for opportunities in the same countries that have become manufacturing competitors. Rising energy prices, and the inevitable removal of energy subsidies, will push these manufacturers to focus on their domestic and regional consumers, redefining their marketing challenges. This trend will produce new opportunities, the true scope of which is yet to be understood.

The party built on centuries of cheap energy is running out of steam. The new party built on creativity and energy efficiency is just beginning. On balance, there is probably more good news than bad in rising energy prices.

Peter Garforth is principal of Garforth International LLC, Toledo, Ohio. He can be reached at garforthp@cs.com.
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