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THE CLIENTS' VIEW OF CBM IN 2001

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Abstract: Advances in condition-based maintenance (CBM) are being driven by an array of technologies, including: speed and miniaturization of signal processing hardware; improvements in power supplies and sources; and smaller, lower-cost RF transmitters. As the set of industries and organizations that are developing and integrating these technologies into CBM components and systems move forward, they should insure that a balance is achieved between technology-push and customer-pull. The existing and potential customers span a wide range of technical sophistication. Many have a thorough understanding of the science and engineering behind the CBM systems that are evolving. Others, just as important as customers, look to us, to provide them with the appropriate tools to achieve the savings and productivity they have been led to expect.

Failure to provide not only excellent engineering, but also good fit, will result in black eyes for all of us. Less noble, but more obvious, we will fail as business people if we don't listen to our customers.

The author has had the good fortune to deal with CBM clients ten years ago and to find himself back in that community again. Comparisons are available, and trends stand out. The customers are, indeed, different.

Key words: Condition-based maintenance; customers; open systems; wireless.

PICK YOUR CUSTOMER: The people responsible for financial results are becoming the customers and supporters of CBM. Efforts to educate and markets to the power generation industry in the late Eighties all to often ended with such statements as: "Your CBM stuff requires approval as a capitol purchase; if we had any funds available for capitol equipment, we would spend it on revenue-generating equipment". The company from which that statement came is now a leader in CBM applications, pulling our industry to provide the maintenance cost-saving tools they need. The difference appears to be in the substantially improved tracking of the costs of maintenance. Perhaps deregulation of the electric power generating industry has opened eyes, to the benefit of those who are reading this paper.

Lagging in that industry, and in many manufacturing facilities as well, is acceptance of CBM by the people who are responsible for the day-to-day status of machinery. Several explanations are available. If we do our jobs, some of them lose theirs. When we hear cost cutting on the business news, it means payroll reductions. The obvious virtues of CBM include replacing the human monitor with a device, but more threatening is substantial reductions in both preventive maintenance hours and repair hours following run-to-failure events. Emergency repairs are all to often the makers of heroes. Taken to

its criminal extreme, sabotage is the result. The author, like many of the readers, has witnessed examples of this behavior. The point for our industry is that we should be aware of this psychology and know whom we are talking to in our client base. The marketing manager who is handed off to the client's maintenance manager and told that that is who he must sell, has his work cut out for him. Given the choice, find the person who will be promoted if maintenance costs are reduced, emergencies eliminated, and uptime is improved.

A large and important set of potential clients traditionally makes a nice profit selling replacement parts. In industries like aviation that are, of necessity, conservative, CBM may be a harder sell than common sense would indicate. The author has watched as the message sunk in: CBM is inevitable, and we will no longer laugh all the way to the bank as we sell spares that are not needed. Power by the hour and similar programs should be on the tip of your tongue. It is certainly costing someone dollars per hour to fly or operate, and the human who knows, to the penny, what that cost is, is a good starting point for briefing CBM in organizations which are sellers of spares for their own equipment.

In recent discussions with a small company that manufactures equipment for chemical and environmental applications, another consideration and a very positive indicator of the strength of CBM was offered by the client: CBM as a product discriminator. The VP of Marketing, with little background in maintenance, recognized the marketing importance of being the first in their industry to offer a CBM approach to maintaining their equipment. The set of questions that followed included the possibility of exclusivity, and lengthy discussions about warranties, service and all that goes with the "Who is going to watch the scope?" set of issues. Those of us who are systems integrators need to ensure that we understand just where the boundaries of those systems are, and those of us who want to sell elements of systems need to have the larger picture as well. Perhaps we all need our virtual teams, bench strength and all, in place as we describe CBM to the universe of potential users. New applications are numerous, and the CBM story is grasped very, quickly. The questions that follow will test the best of us before we sell systems or system elements.

DATA FUSION: A monitoring system was installed in a nuclear electric power generation plant in 1990, which contributed significantly to bottom line improvements within weeks of installation. The system monitored vibration; the facility already had thermocouples on the bearings of the generator sets. Two thermocouple indications of problems occurred; both subsequently proved to attributable to faulty/failed thermocouple wiring. The human operators made the comparisons between the heat and vibration sensing systems, and determined which was the correct indication. Various lessons are supported by this event. Data fusion need not be complex; conversely, it should be part of most systems. Systems we deliver in this decade should sort out such ambiguities without human help or intervention. Beyond such simplistic multi-data events, powerful data fusion tools are appearing.

Beware the sensor that measures one variable and purports to tell the remaining useful life of a component. Be it vibration, lube spectroscopy, temperature, or pressure, get a confirming "second opinion". "Is it a faulty fire warning system, or am I really on fire?" the pilot asked before ejecting from his single-engine jet. Similarly, the plant manager wants to be very sure before he orders parts, schedules a shut down and replaces a perfectly good bearing. Data fusion is powerful stuff that will help put CBM on the map

BE WIRELESS: That 1990 monitoring system described above sent data by wire to the signal processing hardware, and the information generated by wire to the human interface screens. The wiring installation cost more than the rest of system. Although the wiring had been done during a planned outage, the facility management became aware of the hours incurred during the installation. Although the thermocouple occurrences saved the facility more than the cost of the monitoring system, citing system cost, the management could not be convinced to purchase another vibration monitoring system. Real reasons, one could conclude: recognition that the wiring became a maintenance burden of its own as it had with the thermocouple; and wiring more than doubled the initial cost of the system. We must have wireless system in our bag of products.

Ongoing dialogs with several companies confirm the importance of wireless systems. The managers of an automotive parts manufacturing facility recognize the need for monitoring and diagnostics at various choke points. Wiring will not stand up to the environment. A manufacturer of test cells had been unwilling to discuss wireless systems in his cells until his customers recently inquiring about wireless technologies, citing electrical problems as accounting for 85% of down time. A manufacturer of plant equipment for several industries is now eager to include CBM as a part of his systems, citing his own experience with wiring maintenance costs, and reluctance of his customers to deal with more wire. A heavy equipment manufacturer recently revealed that he had a sensor design on the shelf, with intellectual property locked in, because the intended environment was hostile to wires. Wireless systems are now in demand, are what will make CBM work, and are what will sell.

OPEN SYSTEMS: Closed systems have limited the growth of CBM, and, in many cases, given our community a bad name. Educate your clients as to the meaning and importance of open system architecture, support the development of the needed standards, and spent your intellectual property dollars elsewhere. In Marketing I parlance, we can grow the pie faster than any of us can keep up. Don't hurt us all by trying to defend your slice.

LEGACY SYSTEMS OR OEMS?: The author was recently asked whether his marketing plan was aimed at retrofit on legacy systems or at embedded sensors sold to the OEMs for new, smart machines. "All of the above" is not an easy answer to defend. Beware the assumption that the same systems are good fits for both sets of application. None of us will ignore the huge OEM market, and the bright future it holds for CBM, but, likewise, we note that the average US Air Force aircraft is twenty years old, and the US Navy has ships on the seas that will still be there forty years from now. Manufacturing equipment and other CBM candidates split in similar proportions. The recommendation

is: polish up two stories, and be tuned to the distinctions. Back to Marketing I, they are both huge pies. Perhaps some of us should feed from one and not the other.

SUMMARY: CBM is becoming accepted at an accelerated rate. The folks who count the beans see the payback both in organizations that previously rejected CBM, and in new applications. As power by the hour, and improved methods of tracking maintenance costs grow, the acceleration of CBM will continue. Those of us positioned to influence the direction of CBM should stoke these flames with open system standards, data fusion approaches, and, where warranted, wireless systems. One size does not fit all: ensure excellence for both our legacy system clients and the OEM market.