Servicing X-Ray: A Shifting Paradigm

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Servicing and maintaining x-ray equipment has long been a fundamental component of the work of biomedical technicians. For the most part, such equipment has consisted of large, immovable, durable, analog-based pieces. Advances in technology, though, mean that smaller, digital-based x-ray equipment is steadily gaining ground in the marketplace; and that means biomeds must upgrade their skills to better manage it.

John Storch, a radiology equipment specialist in the clinical engineering department at the West Allis Memorial Hospital (West Allis, Wis), is responsible for nearly 30 x-ray devices in his facility.

"We still have mainly analog equipment, but as older pieces of equipment are being retired, they are being replaced with [digital radiology] in anticipation of having a PACS [picture archiving and communication system] by the end of 2005," says Storch. He is responsible for scheduled and unscheduled maintenance of all the general radiology, mammography, fluoroscopy, and tomography x-ray rooms; portable x-ray units; c-arms; and diagnostic ultrasound units at West Allis Memorial, as well as at six other clinics in the Aurora Healthcare network. "For those pieces of equipment that

we don't expect to have replaced by then, we have already implemented [computed radiology] so those images can be stored as well."

Gaylen Blackford, director of marketing communications for customer service at Philips Medical Systems (Bothell, Wash), says that although the older models still last a long time, the digital age of x-ray equipment is coming fast.

"X-ray equipment is moving into a digital world," agrees Todd Reinke, director of customer service for Philips. "Digital detectors are already prevalent on most new products in the field, because that technology offers images that can be viewed on a monitor as well as be distributed through the whole PACS environment, and that product offers improved reliability."

Digital x-ray equipment requires that biomeds be extremely savvy and conversant in networking and in using diagnostic software to analyze issues going on with the system, according to Bob Faries, product service manager for Philips.

"In many cases the system has remote-service capability, so we can sometimes help that engineer decipher what is going on," Faries says. "However, the biomed must have network/DICOM knowledge to handle issues that will arise with newer technology."

Taking Advantage of Training

Whether dealing with analog or digital models, biomeds need specialized skills to work on x-ray equipment.

"Working on x-ray equipment does require some degree of special training," Storch says. "While portions of systems do rely on basic electronics, which general biomeds can easily work on, x-ray has its own unique hazards of high voltage and radiation. At the very least, this must be learned before servicing any x-ray equipment.

"In addition, x-ray theory is important for proper troubleshooting and knowledge of state/federal regulations to know when a system is considered safe or unsafe for operator or patient use," he adds. "I've found that the courses offered by some independent x-ray schools are very beneficial."

Working on digital x-ray equipment requires specialized skills that biomeds can learn by taking classes offered by independent schools or original equipment manufacturers.

For the newer digital technology, biomeds are getting further education from the original equipment manufacturers. As Reinke notes, going

from analog to digital means learning a whole new product—this is no longer a case of biomeds pulling out a screwdriver to make adjustments.

"We have a number of offerings to allow hospitals and clinics to use their own staff of biomeds to service the equipment," Reinke says. "After the warranty period, customers are free to choose the best service alternative for their digital x-ray system. We will provide qualified in-house engineers with the appropriate service training. Actually, what we provide biomeds is the exact same training that Philips technologists get."

Ron R. Sullivan is the GM services marketing manager for GE Healthcare (Waukesha, Wis), and his team is responsible for market strategy and execution for the GE Healthcare Services business. That includes the service training component.

"With the increasing design and technical complexity brought on by the advent of digital detector technology, service training is essential," Sullivan says. "Inexperience and lack of technical understanding in servicing digital x-ray equipment can lead to increased downtime, deterioration of the digital detector, and degradation of image quality. Highly specialized training that covers, among other things, radiation physics, imaging, networks, electronics, and radiation safety is required. In addition, most training is highly product specific because different OEMs use different design philosophies and software."

Indeed, as products move forward in improvements in technology, it is not just a matter of walking in off the street and getting training, according to Faries. An extensive historical background in servicing x-ray equipment will help any biomed better grasp the newer technology.

"When biomeds are involved with the history of how a product evolved, they are much stronger employees because they have seen it go through development," Faries says. "Even when they are not quite expert, such biomeds can have extensive background experience that adds to their skills."

Troubleshooting

Past experience with x-ray equipment leads many biomeds to realize that many times the issues encountered are mechanical in nature. Much of preventive maintenance, therefore, focuses on safety issues, such as counterpoise/counterweight cables and making sure detents are secure, components move smoothly, and there are no loose parts.

"Also, due to high electrical voltages, making sure the federal connectors are properly insulated is important to prevent tube/system damage," Storch says. "And of course,

it's critical to keep the system clean."

For the newer digital equipment, Sullivan notes that there are few issues with hardware and digital detector reliability.

"Performing PM per the recommended schedule is the best way to mitigate most issues," he says. "Some more frequent maintenance issues might include image-quality issues with end consumers and the use of the right protocols. We also have some troubleshooting high-voltage generator and general power quality issues, interaction of software with systems internal to the customer, networking, including integration with hospital PACS, and fast-moving technology and component obsolescence."

"Correctly servicing equipment generally requires three things: labor, parts, and access to servicing intellectual property," Reinke says. "As the OEM, we can provide OEM-quality parts and service the intellectual property necessary to correctly diagnose and service the system. We have a full portfolio of offerings from comprehensive service agreements to three offerings specifically targeted to in-house service.

In most cases, Reinke says, Philips partners with a biomed to provide service.

"We provide the parts and they provide the labor," he says. "Also as the OEM, we do a licensing agreement to service intellectual property. In the best-case scenario, it is nearly equivalent to us doing the work because they have highly trained people, they are buying the correct parts, and they have the license to service the intellectual property.

"There are those that choose not to buy the license or get the training, and to buy parts elsewhere," he continues. "From that perspective, I think a biomed would not be suited to service equipment at the same level as the OEM."

"We can provide the labor, and in some cases we have a better and faster response time," Reinke says. "In addition to providing remote support, Phillips provides technical remote support to biomedical groups, so they have access to the same technology support experts that our own field experts have access to. Not all OEMs have consistent behavior or offer remote technical support to customer biomedical engineers."

Sullivan maintains that the OEM is clearly the best source of service for x-ray equipment, especially with the newer digital systems and with newer specialized software.

"OEM engineers have the most in-depth training and knowledge on the highly specialized product design and software," Sullivan says. "If an x-ray system is to be serviced by an in-house engineer, then GE support in the areas of class C advanced diagnostic tools, remote online center expert support is a must to maintain product and image quality."

Whether x-ray equipment can be maintained by in-house departments as well as by manufacturers depends on several factors, including how much equipment a department is already taking on and how many bodies they have, according to Storch.

"At least some work can be done in-house," he says. "To get started, you only really need a few specialized pieces of test equipment. With those, you can do the PMs and some minor repairs on a majority of the equipment.

"Every now and then, you might run into a problem that requires a specialized tool or knowledge that isn't worth the hospital's investment," he adds. "That might be when to call in the manufacturer. Even if a facility does have imaging specialists, that doesn't mean they have to do all of the work by themselves. Clinical engineering has to decide what is best for the hospital on a case-by-case basis, and that means having knowledge of an imaging department's workflow as well."

And while Storch concedes that based solely on the cost of materials, biomeds may be able to save the hospital money by doing things themselves, time may be of the essence as well.

"What if this is the only room with an upright bucky? What is the cost of lost patient revenues?" he says. "If it was a patient monitor, you could give them a spare, but there are no spare radiology rooms you can just wheel in. In a particular instance, calling in the manufacturer might be the best way to go even if the cost of time and materials is a bit higher."

Riding the Learning Curve

Whereas older systems relied very heavily on adjusting and tweaking on the part of the biomeds, Faries notes that systems are now more software driven—which can equate to a bit of a learning curve for biomeds.

"Algorithms drive the configuration now, and that reduces the number of calibrations needed because software doesn't deviate," he explains. "It's not like old days where we could walk up to the cabinet, bang on the relays and have it work again. Thanks to the solid-state technology we now use, those days are long gone."

Just as in most cases of advancing technology, biomeds tend to be excited about the change, and in many cases, although the applications are more complex, the process is becoming simpler. Reinke also notes that, in his experience, biomeds servicing other digital products tend to be successful with digital x-ray.

"If I have the right people with the right experience and aptitude, I can train them to be excellent service engineers," Reinke says. "But experience does help that equation."

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