

Implementation of a Homegrown Computerized Management System

Kent Cox and Steve Gordon

Like many biomedical repair entities, the Southern California Permanente Medical Group (SCMPG) Laboratory Instrumentation Department began as a small repair support group and experienced growing pains. By the late 1980s, the number of clinics and hospitals being serviced, the sheer number of instruments, and the regulatory demands on procedure, documentation, and personnel training had grown to the point where manual accounting methods were inefficient. It became apparent that a computerized system would be needed, but the specifics were unclear.

Background

The department serviced 11 major hospitals, two large reference labs, and approximately 80 clinics spread out across seven major counties. Over 11,000 pieces of equipment required inventory tracking, repair, and preventive maintenance (PM). There was a mix of manufacturers and models, with some instruments serviced by the department and others on varying warranty schedules. To make matters more complicated, some instruments were serviced in the field while others were sent to and from the shop via a courier system.

There were other areas of department responsibility that needed to be considered. The department was tasked with the production of documents for all daily, weekly, quarterly, and semi-annual sign off sheets for all instruments and locations. This amounted to approximately 18,000 separate papers. Providing annual cali-

bration and documentation for about 1,500 thermometers was also required. All documentation needed to comply with the Joint Commission on Accreditation of Healthcare Organization (JCAHO) and the College of American Pathologists (CAP) standards, and be capable of keeping up with evolving requirements.

In addition, the department was playing an increasing role in asset management, equipment recommendations, and procurement. The growing task list required analysis software to help evaluate track records of various instrument brands and models in correlation with repair costs (time and parts) and relative instrument workload. Tracking and documenting continuing education and factory certification for field service personnel was another area that needed increased attention.

Several off the shelf (OTS) software products were examined. Each product offered functionality in some areas, but none provided a complete solution to our needs. One particular product was commonly used in the biomedical field and offered great flexibility. However, the drawbacks were slow performance, awkward maintenance, and no avenue for adding unique areas of functionality. These factors were weighed against the cost of internal software development and maintenance. The needed skills for programming, networking, and hardware were present in the department, which was technical in nature. This trade-off of resource expenditure vs. OTS purchase may not work for all service groups, especially where department size and budget are prohibitive.

A decision was made to develop custom software and the following areas of functionality were identified:

1. Inventory and asset management of laboratory equipment
2. Form publication services: providing laboratory clients with daily, quarterly, and semi-annual maintenance forms for all equipment
3. Service call management and history: tracking repairs from their initial request through work completion



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4. PM management:
 - A. Schedule generation
 - B. Client notification
 - C. Completion status
 - D. PM histories
 - E. Maintenance and publication of PM policies and procedures for all equipment
 - F. Annual electrical safety checks and documentation of all equipment
5. Parts management: tracking parts inventory, usage, and ordering
6. Analysis tools to monitor employee deployment patterns, failure-prone instruments, and comparative equipment work loads
7. Tracking of employee training and certification.

As a result, a computer system was developed that is tightly integrated with the processes of the department, and at the same time can be modified over time to meet changing requirements.

System Overview

The computer system is Windows based with a central database server, two Web servers, and approximately 30 client workstations. The system is tied to the national corporate wide area network (WAN), and as such is visible from all laboratory locations. Laptop computers can be taken into the field and kept synchronized with the main database.

Central to the system is inventory management. As teams are sent out to do PM during the year, they also note additions, removals, and changes of equipment status. This information is updated in the central inventory database. Additionally, our client sites are motivated to help keep the inventory correct because they cannot receive repair service or paperwork if an instrument is not registered in our database. This completes the circle and helps keep the inventory accurate.

To aid in inventory, the department has developed a bar coded sticker, which uniquely identifies a piece of equipment. An in-house instrument reference (IR) number is used to guarantee uniqueness. This is necessary because a unique serial number cannot be guaranteed when multiple manufacturers are involved.

All maintenance and sign off documents are printed based on this accurate inventory. Each site receives its documentation at the beginning of the year and is required by law to maintain and show this documentation to CAP, JCAHO, and state inspectors upon demand. The

overall process ensures that document forms are consistent across the region and for all equipment model types. Clients can also view their site's inventory on our Web site.

Documents for blood bank and blood donor centers must further comply with FDA specifications. A yearly review process with a change control committee ensures keeping up with changing FDA requirements and with the needs of the individual blood centers.

The repair process begins when a client either phones in or submits a service request online. In either case, the service analyst logs the call and assigns it to an available and appropriately qualified field service engineer. Pending work is monitored by the service analyst—with the help of analysis software—to identify delayed repairs or recurring problems. Upon completion of repair, the engineer closes the work order on his/her workstation computer.

PM schedules are generated automatically in December for the upcoming year. The schedule is based on the prior year's schedule and any current changes in inventory status. Mainline analyzers are assigned to qualified engineers and general equipment is handled by PM teams. A

Pros and Cons of Developing Your Own Computerized System

Pros:

- Complete control of the functionality and content
- Ability to integrate unique features and function into the system
- Financial savings on purchases, upgrades, and licenses of an OTS product
- Ability to refine and modify the product over time to meet changing requirements and demands
- No risk of a commercial software maker discontinuing a product or support.

Cons:

- Time and money for design and development
- Costs of software development tools
- Possible risk of not being able to keep up with changing needs because software development is not the primary role of the department.

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lead engineer customizes the PM schedule to better fit the work distribution of the current year. Upon completion, the entire schedule is printed and copies sent to the client labs. A library of vendor compliant maintenance procedures is kept in the database. A check list of the required procedures for any given instrument can be printed out and taken into the field by the assigned engineer. An engineer's sign off constitutes a legal agreement that he or she has completed the appropriate procedures for the relevant instrument. Again, the service analyst with software assistance monitors the progress of PM completion.

Parts inventory is handled by a tool crib attendant. The computer system keeps a listing of parts, quantities, vendors, and manufacturers. As engineers fill out their work orders, they also list any parts used. This helps in parts re-ordering and monitoring usage and cost.

A separate administrative reporting tool provides management a way of viewing trends and possible problems.

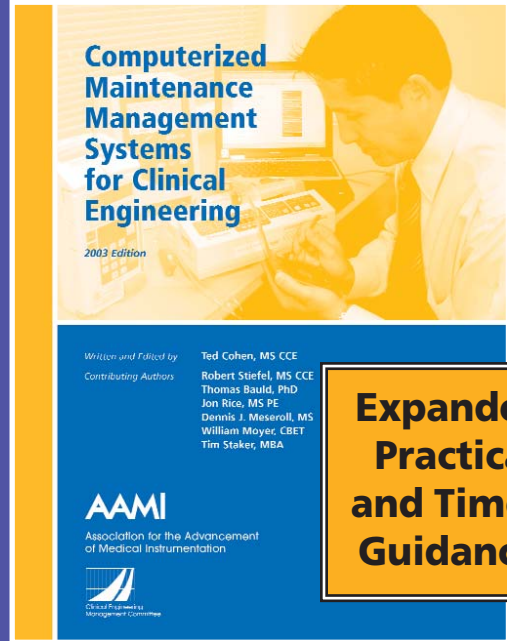
"Being able to adapt to evolving standards of health care regulation is a challenge to all medical instrumentation service groups."

There are reports that show average time between failures, response time, employee work efficiency, failure-prone instruments, correlations between an instruments' relative workload and its repair costs, PM completion status, and asset depreciation.

Finally, employee training and factory certification is tracked by software. This information is used in PM scheduling and repair deployment. Department supervisors ensure that engineers are kept current with relevant training for their assigned areas of specialty.

Being able to adapt to evolving standards of health care regulation is a challenge to all medical instrumentation service groups. Flexibility has been an on-going design goal in this system and has served us well. ■

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