

## **A Combined Calibration and Repair Department: The Smart Choice for A Biotechnology Company**

Speaker/Author: Karl Wigdal  
Promega Corporation  
5445 East Cheryl Parkway  
Madison WI, 53711  
(608) 277-2633 phone  
(608) 277-2516 fax  
[kwigdal@promega.com](mailto:kwigdal@promega.com)

### **Abstract**

Many biotechnology companies feel they cannot afford to have a calibration and/or repair department. In an attempt to save money, they hire outside vendors on an as needed basis. However, this is not necessarily a money saving strategy. At Promega Corporation, a biotechnology company, their metrology department provides comprehensive in-house support for the calibration and repair of the large variety of test equipment used throughout the company. Having a metrology department that combines calibration and repair functions resulted in substantial savings as well as a 66% decrease in down time for vital test equipment. The ability to provide accurate, traceable and repeatable test equipment measurements, through timely calibration and repair support, will improve the success and bottom line of your company.

**1 Introduction:** Promega Corporation is a worldwide leader in applying biochemistry and molecular biology to the development of innovative, high-value products for the life science market. Promega's metrology department supports over 6,500 pieces of laboratory equipment, with more than 3,700 items requiring calibration and/or preventive maintenance inspections. Within that list are 283 different types of equipment made by 383 different manufacturers. We support this inventory with only two calibration technicians, one electronics repairman and one manager/senior metrologist in a combined calibration and repair department that provides traceable calibrations and a complete, in-house repair service for most items.

When looking at the large variety of equipment, one may wonder how such a small department supports all the calibrations and repairs. We are able to provide this high quality service through the proper selection of our staff, the use of software to schedule work and the training of departmental personnel. In this paper, I will discuss some of the benefits that combining a calibration department with a repair department can provide to a company. And, why it was a smart choice for Promega, allowing us, over a five-year period, to decrease equipment repairs by 66% while at the same time increasing the number of equipment supported by 83%, all without an increase in personnel. I will then leave you with some of the lessons that were learned along the way.

**2 Benefits of a combined calibration and repair department:** When the management of a biotechnology company decides that it is time to confront the issue of how to maintain and calibrate the bewildering numbers and variety of the test equipment used to develop, manufacture, package and deliver product to their customers, they should consider a combined calibration and repair department as a solution. Let us look at the following benefits that can be

derived from such a department. Promega has experienced a decrease in the frequency of equipment repairs due to failed calibrations and equipment failures because of their combined calibration and repair department. This combined department was able to reduce the number of equipment failures primarily due to performing preventive maintenance routines as part of the calibration procedure, gaining technical insight by performing all aspects of equipment support within the department and analyzing trends in equipment failures through the use of computer software. All of this translated into impressive savings in equipment support related costs.

**2.1 Performing preventive maintenance as part of the calibration procedure:** “Down time” for test equipment occurs when the equipment either fails to work properly or when it fails to meet the required calibration specifications. In both cases, the test equipment must be repaired before it can be used in an ISO certified or GMP compliant company. The most effective method of decreasing this down time is to perform preventive maintenance inspections (PMs) when applicable. Performing PMs for test equipment is analogous to getting a tune-up for your vehicle. Depending on the type of test equipment, different protocols are used for the PMs. For example, thermal cyclers are vacuumed to remove the dust; coolant levels are checked and adjusted as necessary, etc. Just as with an automobile, regularly scheduled PMs for test equipment can greatly increase the life of the machine. For ease of scheduling and efficiency in workloads, PMs are performed at the time of the item’s calibration. However, performing the PM and any necessary adjustments, as well as recording any service performed, between gathering the calibration “As Found” and “As Left” data takes extra time. Taking extra time costs money and why would anyone want to spend extra money? Since Promega decided to spend the extra time and money to pursue this approach to equipment support five years ago, we have experienced an overall decrease of 66% in repair rates and an overall decrease in failed calibrations for the equipment that we support. We believe the single most important factor in this decrease in failure rates is our preventive maintenance program.

By adding the PM procedure to the applicable calibration, we are able to ensure that equipment failures are often times discovered and corrected before they cause the machine to fall out of specifications. The defect has no chance to damage or degrade the piece of test equipment further. Moreover, the failing equipment will not produce defective product, give false information to a researcher nor cause the tight production schedule of our company to fall into disarray. This means that our customers can have the reagents they need when they need them. This equates to a very large impact on the bottom line of Promega, as well as any other company, for a very small investment in time and effort by a very few people. For example at Promega, thermal cyclers experienced a decrease in calibration failure rates from ten failures before beginning combining calibrations with PMs to zero afterwards. As a further example, thermal cyclers, centrifuges, spectrophotometers and fraction collectors all experienced a reduction in repair rates by 57%, 66%, 100% and 100% respectively. This was all a result of performing PMs on a regular basis.

**2.2 Gaining technical insight by performing all aspects of equipment support:** When the personnel performing calibrations on a particular piece of equipment is the same person that performs PM procedures, as well as any repairs that may be required, an intimate familiarity with that equipment evolves that is not possible any other way. We have found that the value of knowing a machine “inside and out” reduces equipment related failure and resultant down time

of that equipment. This is primarily due to three factors; 1) recognizing a defect during a routine calibration, even if the equipment passes calibration, 2) recognizing problems during a service call, and 3) effective communication amongst the department members as well as with our customers.

**2.3 Recognizing a failure during a routine calibration:** If, during a scheduled calibration, a piece of equipment fails to meet the set specifications, steps will be taken to inform the user, remove it from service, repair and/or adjust it and return it to service if possible. This standard protocol should happen anytime that a piece of equipment fails the calibration procedure, in any company that relies on an internal or external supplier for its calibration needs. However, we feel that this approach is not good enough. A machine can pass its calibration, yet be in need of repairs. Let me rephrase this because it is an important, but not obvious, concept. A piece of test equipment can pass calibration and meet specifications, even while it is in the process of breaking. One example is when a thermalcycler has low coolant levels due to a leak in its cooling system, it may still meet specifications and even pass its diagnostic tests, though it is in need of repair. If the equipment is not repaired it will continue to decline in performance until the inevitable happens. Eventually it will break down and produce incorrect information or defective product. To then correct the errors caused by the failing equipment takes additional time and money. In other words, it will cost money beyond the mere repair costs, potentially hundreds or thousands of times more than the repair cost alone. Because we perform all the calibrations and PMs in-house, we have the past records of how a specific piece of equipment “normally” behaves. When performing a regularly scheduled calibration, we can detect when the equipment is beginning to fall out of specifications and starting to fail, even if the equipment still meets the set specifications. In this way, we are able to correct/repair equipment before it ever causes problems for the company.

**2.4 Recognizing problems during a service call:** When a scientist at Promega has a problem with a piece of equipment, they notify the metrology department through our intranet work order system. The repairperson that arrives to service the equipment already has some insight into that piece of test equipment because he or she has performed PMs and calibrations on the specific machine as well as other similar equipment in the company. It is often the case that the repairperson has spent years calibrating and performing PMs on this type of equipment.

The person will not only know the principles of how the equipment works, but they will have learned all of the idiosyncrasies of it as well. They will know all of the noises it makes, and all of the pauses it takes while operating, as well as other traits of the specific machine that are not in any service or user’s manual. While the technician is gathering any data during the diagnostic phase of the repair, such as “As Found” calibration values or diagnostic test results, they will be able to rely not only on past data recorded during previous calibrations and information found in service manuals, but they will also have personal experience to rely on. We have found that personal experience, while the most difficult to quantify and define, is perhaps the most valuable asset that a member of our department can use in the support of equipment.

**2.5 Effective communication:** “Knowledge is power”. This simple misstatement is the basis of our policy of free and open communication among department members. When knowledge is kept to ones self, that knowledge can appear to enhance the status, prestige and importance of an

individual. This is a self-serving, but ultimately self-defeating, behavior that should not be allowed because it hampers the overall effectiveness of the department. When knowledge and technical know how is shared, everybody benefits. Each department member becomes more effective in performing their jobs, and thus the company is able to develop, produce and distribute products in an efficient cost effective manner. Shared knowledge among Promega's metrology department members affects the company's bottom line in a very positive way.

Effective communication allows the personal experience and insight of each department member to be utilized effectively by the entire department. The Promega metrology department encourages communication amongst its members with an open and friendly atmosphere. While this atmosphere is a start toward effective communication and transfer of knowledge, it is not enough to ensure that important information is disseminated. Promega's metrology department has several mechanisms in place that facilitate knowledge transfer within the department as well as with our customers. The tried and true methods that we have found to be very effective in the exchange of ideas and knowledge are our service notes, weekly staff meetings and lab liaison program.

Each member of the Promega metrology department has their own computer, which is connected to the Promega intranet. The department has its own private networked drive, available only to personnel within the department while they are logged on to the system using their unique password. That is where we keep our "service notes" as well as other operational information. The service notes contain all the collected knowledge of every piece of equipment that the department supports. All of the idiosyncrasies, shortcuts, troubleshooting techniques, repair procedures, refurbishing procedures, alternate part suppliers, common failures, alignment procedures and other useful information are recorded in the service notes. When a member of the department encounters a situation that is unusual or out of the ordinary, or when a method to save time is discovered, they are required to record the specific information as to the problem and what they did to solve it in the service notes. This policy has given great results, allowing us to build the service notes into our own private reference library.

Metrology staff meetings are conducted so that departmental operations are addressed on a weekly basis. The schedule of calibrations for the upcoming month is reviewed and tasks are assigned to ensure that no item is neglected or overlooked. Any outstanding repair requests are reviewed and discussed. All aspects of the daily operations of the department are reviewed in detail and decisions regarding these details are made in the weekly meeting. This is always done in an open manner with all departmental personnel present. After the weekly topics have been covered, tasks assigned and decisions made, the meeting opens up into a round table discussion. At this point everyone has a chance to bring anything to the floor. This may be an update of ongoing issues, troubles, etc. The staff meeting is a place and time when relevant topics are reviewed, talked about and worked out among the department personnel. It is a very effective method of communication within the department, one that greatly enhances our collective knowledge about the equipment that we support and the issues concerning them.

Our metrology department has a method of communicating with our customers called the lab liaison program. Promega has a large and disbursed campus, employing many scientists. Scheduling calibrations and service for the equipment would be very difficult if it were not for

our lab liaison program. We have found that by assigning a scientist from each laboratory the task of tracking the equipment and coordinating calibrations with the equipment users, we have eliminated scheduling and related problems. Having a lab liaison or “go to” person for each laboratory is an essential part of the Promega metrology program.

**2.6 Analysis of failures, predicting the future:** How many times have you heard “If only I had a crystal ball, I could have seen this coming and avoided it. It’s not MY fault...” Well, I am happy to say that at Promega the metrology department HAS a crystal ball! We call our crystal ball MAMS, which stands for Metrology Automated Management System. It isn’t as exciting or romantic as a real crystal ball, but is more effective. MAMS is our software system, developed and written in-house. It is our database, with built in analysis functions, that contains all of the equipment supported by Promega’s metrology department. Along with each piece of equipment filed in the MAMS database is stored all of the information relating to it such as manufacturer, model and serial number, location, calibration interval, calibration and repair history. In other words, MAMS has everything that there is to know about each piece of Promega’s equipment. There are several software packages on the market that perform the functions that our in house program does. It is not possible to successfully run a metrology department without such software. Software is a “must have” asset for any metrology department.

Some of the analysis features of MAMS include the ability to generate a 30 day forecast of all scheduled calibrations and PMs, generate a list of overdue calibrations (god forbid!), display all open requests for repairs/calibrations (work orders) and display a work order history of individual pieces of test equipment including time and money spent. In addition, MAMS can display production totals for the department either by individual personnel or as a whole. We also use the MAMS integrated software package to predict the future by analyzing the trends involving equipment failures and the analysis of calibration intervals.

The analysis of trends in equipment failures fall into two types: the failure of the equipment to meet specifications during a scheduled calibration and the outright failure of the equipment resulting in a repair to restore the unit to operability. A trend of the first type of failure described, the failure of equipment to meet specifications during a calibration, may not become apparent until an analysis of historical calibration data occurs, as when we review our calibration intervals.

Once the tracking of equipment through the use of MAMS was in place for 32 months, we had enough history to begin an analysis of the calibration intervals for different types of equipment. We analyzed the data for both calibrations and repairs. For example, we determined how often the equipment was out of specifications when it was calibrated and how often the equipment broke down or failed requiring repairs and calibration/PM. Based on our analysis, we were able to extend the calibration intervals for nine types of equipment while maintaining a calibration pass rate of greater than 98%. If we had only used historical data from calibrations, and not the repair data, the results may not have been as impressive. But, we also had the benefit of the data collected by our department during the PMs and repairs, as well as the insights of seasoned repair personnel. When this additional information was considered we arrived at a different set of conclusions as to which intervals should change and which should remain at the current calibration interval.

We have reviewed and adjusted our calibration intervals twice since the Promega metrology program was initiated in September of 1997. It is very clear that the contribution of the repair section of the department was a significant factor in the achievement of our goal to maintain a calibration pass rate of greater than 98% after the adjustment of calibration intervals.

It is much easier to recognize the second type of trend in failures, the outright failure of the equipment, if your department is an integrated calibration and repair department. If a company utilizes outside vendors for the repair of equipment, there may be no central location or department tracking these equipment failures. There could quite literally be an unrecognized epidemic of equipment failures within a company that is draining it of funds, either through repair costs, equipment replacement costs or production related issues.

Let one of Promega metrology's achievements serve as an example of how the approach of combining a calibration with a repair department saved the company money. A trend in thermal cycler equipment failure was recognized, a solution was implemented and the problem was resolved. One of the ever-present pieces of equipment in any biotechnology company is the thermal cycler. A thermal cycler is a programmable temperature block with precisely controlled patterns of temperature changes. A small amount of DNA is put into a tube, along with other reagents, and the tube is placed into the thermal cycler. With the correct program, the thermal cycler will execute a cyclic series of precise temperature changes and the quantity of DNA will double with each temperature cycle. The end product, after many temperature cycles, is a large amount of DNA that is identical to the original. This process is called polymerase chain reaction (PCR) and it is one of the most important tools in modern biotechnology. If the temperature of the sample block in a thermal cycler deviates from specifications, the PCR process may not work properly, or not at all. PCR can be used to confirm the identity of the father in paternity tests, identify criminal and/or victim from a violent crime scene or identify certain illnesses or genetic diseases. In the case of a crime scene, the evidence may only be found in small quantities, such as a blood spot. If the PCR process fails, the evidence may be wasted and the crime may go unsolved. Every day very important, often times life and death decisions in people's lives are made from the results from PCR based tests.

Promega, like many other biotechnology companies, rely on thermal cyclers extensively. Within the company there are 50 thermal cyclers. Of that number, 26 are of the same make and model, and they were beginning to break down in increasing rates. Because of the combined calibration and repair department at Promega, this trend was recognized early. The accessibility of detailed records for each thermal cycler when combined with the expertise of the staff allowed an in depth analysis of the problem. It was discovered that coolant was leaking from the block cooling system and that the root cause was aging O-ring seals. For less than \$100.00 we were able to refurbish the cooling systems of all 26 of these thermal cyclers and eliminate future problems. The end result was that we lowered the repair rates of this machine from 27 repairs for the first two years to four repairs for the next 15 months. The temperature variability between the machines decreased because of the refurbishment program, resulting in a company wide improvement of machine-to-machine repeatability. We saved an eventual \$280,000 in replacement costs for this machine alone! The thermal cycler manufacturer no longer supports

this machine; so when it fails, they will not attempt repairs. The cost savings when related to the impact that this had on production speaks for itself.

**2.7 Reduction in repair and related costs:** At Promega we have found that relying on our in-house metrology and repair department for our equipment support has reduced our repair and related costs a great deal. Following are some examples of money savings.

When considering methods for supporting a piece of test equipment there are two sources for support, an in-house calibration and repair department or an outside source, namely the manufacturer of that equipment. Every manufacturer of scientific test equipment will provide equipment support for its product lines after the warranty expires. This will cost money. The two options of payment for support services are the service contract where the customer essentially extends the warranty of the test equipment, and the “pay as you go” option where the customer pays for any service to the equipment on an as needed basis.

The value of a service contract can often be higher than the money spent on that contract. When you have equipment that must be maintained at all times, when down time is counted in hundreds or even thousands of dollars per hour, the service contract is the best option for equipment support. With the service contract you are buying the expertise of the people that designed and built your equipment, the people that work with the equipment every day and have a large supply of spare parts on hand. When your equipment breaks down, the service provider can repair your machine in a matter of hours. Promega has service contracts on many pieces of equipment for this very reason. We also have service contracts on certain equipment because special tools and training are needed for the support of the equipment that would not make it cost effective to support in-house.

A service contract can cost anywhere from \$1,000 per year to, well, the sky’s the limit. This is not a cost effective option for all equipment in a company because much of the equipment is not critical to operations. If these types of equipment need repair, the whole company does not stop production. At Promega, the majority of the equipment does not have service contracts with the manufacturer for service or comprehensive support. This equipment is not covered under service contract for several reasons. It may not be critical to operations, we may have redundancy of equipment or it may be a very easy piece of equipment to repair. In the last year, Promega metrology supported nine types of equipment that have service contracts available for purchase, but we chose to support them in-house, saving over \$218,000 in service contract costs. As you can see, while the value of a service contract can be very high, in some cases an in-house solution is the better choice.

With equipment that is not covered under a service contract, service and support may be available from the manufacturer on a “pay as you go” basis. The cost of a field service visit can range from \$250 to several thousand dollars. The services provided include calibration, PM and repair. In some emergency cases, it could be well worth the cost of the service visit. The manufacturer can provide the expertise and supply of spare parts needed to get a piece of equipment back into service in a matter of hours. However most of the time, we have found that the pay as you go service call is not required to keep our equipment in working order and our production schedules running smoothly. Replacement of the pay as you go type of service with an in-house calibration and repair department is where the department can really pay for itself. In

2001 the metrology department performed 1,260 repairs and 3,116 calibrations and PMs. When the varying costs associated with the different types of equipment are taken into consideration, we estimate that we saved over \$106,000 by supplying in-house support for equipment versus using the pay as you go approach.

Then there is a range of equipment where the value of the equipment is not high enough to merit a service contract or field service visit from a service engineer, but is certainly too valuable to throw away when it breaks. Sometimes the manufacturer has a service department that will repair broken equipment if you ship it to them. When you add in the shipping costs, you often find that the cost of the repair exceeds the value of the unit. Most of the time, the manufacturer will supply replacement parts and service literature so that the owner of the equipment can take care of the repair. An in-house repair engineer can help pay for him or herself by taking care of all of the little pieces of equipment that break. In the last year we repaired 141 items of equipment that fall into this category. The approximate replacement cost for all of the equipment is \$27,000.

By extending the useful life of equipment beyond the manufacturers support by performing PMs, calibrations and repairs, purchasing new equipment can be delayed. Promega's metrology department has been able to maintain test equipment for many years, while ensuring that it stays within specifications. In many cases even after a manufacturer no longer supports a piece of equipment, the specifications of that machine are as good as the newer models. The older equipment continues to produce results comparable to new equipment. With proper care, replacement of older equipment can be delayed without jeopardizing the integrity of scientific data or products, thus saving money.

**3 How is it done?** The clichéd phrase “people make the difference” is absolutely true. When it is all said and done, all aspects of operation within the Promega metrology department are conceived, planned, implemented, reviewed and improved upon by the people within the department. Without the proper selection of personnel, any such department would not be possible. The understanding of what to look for in personnel, and the care taken to select staff based upon that knowledge is a major reason for the success of this department. Rather than proceed with a detailed description of the management of a metrology department within a biotechnology company, I will focus on the desired qualities to look for in personnel.

The Promega metrology department has the advantage of people with dissimilar but relevant backgrounds. This ensures that the knowledge base of the department is as broad as possible and maximizes the overall utility of the department within the company. The department is comprised of two full time calibration technicians, one repair and calibration technician and a manager/senior metrologist. Both of the full time calibration technicians have backgrounds in biotechnology. The repair and calibration technician has a background in electronic and mechanical repair. The manager has an extensive background in metrology and the management of metrology laboratories. We feel that these diverse backgrounds are the most effective for our department, allowing us to interface with the equipment users and the equipment manufacturers.

**3.1 General personnel qualifications:** The universal traits required for our metrology department personnel, no matter what their background or role, are integrity, attention to detail, ability and willingness to adapt and learn, interest in biotechnology, interest in science in general



and effective communication skills. When looking for potential department members, they must have these traits as well as a “can do” attitude.

**3.2 Full time calibration technicians:** The Promega metrology department currently employs the services of two full time calibration technicians. Their duties include the scheduled calibration and preventive maintenance inspections of the different types of equipment as well as performing special projects throughout the company on an as needed basis. Both technicians have backgrounds in the field of biotechnology. Their familiarity with the biotechnology specific equipment, how it is used and how it affects the productivity of the company has been extremely important for the success of the department.

**3.3 Repair and calibration technician:** Promega’s metrology department also has the services of one repair technician. The duties of this position are the maintenance and repair of the test equipment throughout Promega, performing calibrations and PMs, reviewing new test equipment prior to purchase and acting as a go between with the equipment manufacturers and equipment users.

The desirable background for a repair technician in a biotechnology company would include extensive experience in electronic and mechanical repair. It is mandatory that this person have either a two or a four-year degree in electronics as well as several years experience in troubleshooting and repair of electronic and mechanical systems. We have found that these skills have proven to be especially valuable in this position. As stated earlier, Promega has 283 types of equipment manufactured by 383 manufacturers. Not all of this equipment is electronic in nature, but a great deal of it is. Electronic troubleshooting skills are essential for the repair technician in this environment. The ability to troubleshoot down to the component level, as opposed to the board level should be considered to be a very important technical skill to look for in a prospective repair technician. For this, they should be experienced with digital and analog circuitry. Mechanical skills are as important as electronic skills in a repair technician. Much of the equipment in a biotechnology company has complex mechanisms that may include robotics, fluid handling and other mechanical devices. A familiarity with the various mechanical technologies found in use today is essential.

**3.4 Manager:** The Promega metrology department has as its manager a person with extensive experience in the metrology field, as a calibration technician as well as a manager of metrology laboratories. This person fills the role of departmental manager as well as a “senior metrologist.” When selecting a manager for a metrology department it is mandatory that the person has training in metrology, either through an accredited college program or through the military calibration program. The knowledge received through these channels will allow this person to make decisions involving metrology issues as well as train other department personnel.

**3.5 Training:** Second in importance to proper selection of personnel is their training. It is almost impossible to find somebody with experience and understanding in all the varied fields of metrology, biotechnology, electronics and mechanical systems. The solution to this dilemma is to hire a person with the core of skills that most closely matches your requirements. Then, provide them with the remainder of skills through training. Training is an investment that pays for itself many times over.

At Promega we train new personnel using several different methods. Our first choice for training is an in-house or on the job training approach. Often times the skills and knowledge required to train personnel are already contained within the department. The person providing the training ensures that the trainee receives the needed information, and the trainee is assured of receiving a complete understanding of the topic. This type of training is a cost effective approach where applicable. Some examples of this type of training include teaching metrology basics and simple repair and PM procedures to new personnel. Sometimes knowledge or information is not contained within our department and it must be obtained elsewhere. We look toward an independent study approach whenever possible. The needed information is found by several means such as contacting equipment manufacturers, books, articles, research papers and online sources. Once one person in the department has the needed information, he or she can train the rest of the department. And finally, when the above methods are not available, we send our department personnel to school. Schooling can be in the form of courses through local colleges, technical schools, seminars and NCSLI section or international conferences. Promega has a policy of paying for tuition and allowing a flexible schedule for the person attending outside schooling. The small expense that this incurs is offset by the enhanced productivity of the employee and department.

We have found that training departmental personnel has consistently given us a high return on our investment. Training allows the department to utilize people and resources in the most efficient manner. Training also allows people to grow within their position and within the company. When a person is aware that the company is willing to invest in them they are more likely to stay with the company. This is important when considering that it takes six months to a year for a new employee to become fully operational within the Promega metrology department.

**4 Lessons learned:** I would like to cover some of the lessons that the Promega metrology department has learned since our beginnings. These lessons should help anyone interested in starting a metrology department or enhancing an already existing metrology department. While these are basic ideas, we have found time and time again that they are very important.

Is upper management on board? I cannot over emphasize how important it is to have upper management understand how important an in-house metrology department is to the bottom line of a biotechnology company. When upper management understands that they will receive a large return on their investment of money spent by the metrology department they will be willing to give the resources needed to properly set up and run that department.

It may seem like it costs too much to start a metrology department, but it doesn't. There is an up front cost involved in setting up and equipping a metrology department. The cost of buying standards for calibration and diagnostic equipment for the repair of equipment may seem staggering at first glance. But when you consider the savings that will be achieved by providing the support of test equipment in-house, you realize that the set up costs will be returned in a short time.

Perform PMs along with calibrations whenever possible. Perform PMs on items that do not require calibrations on a regular basis. The performance of basic maintenance on any equipment will prolong its useable life, enhance its accuracy and repeatability and it will save money.

Select the right people! The extra time and effort taken to carefully choose the right people for a particular position in a metrology department will pay off in the long run. When the people within the department exhibit the qualifications stated above, the department has a tendency to run smoothly.

Encourage the training of departmental personnel. Remember that money spent on training gives a high return on investment. Training departmental personnel will greatly enhance the abilities of the personnel and make your department more productive. And, it is much less expensive than hiring more employees.

Involve the metrology department in new equipment purchases. At Promega, the metrology department has authority to block the purchase of new equipment, if we know that the manufacturer does not provide customer support, the equipment is of poor quality or has poor specifications. We also require that all new equipment come with a service manual if we do not already have one. In addition, we inspect and test prospective new equipment whenever possible before allowing its purchase. This helps us to support our customers in the most effective manner.

The Promega metrology department has a motto: “provide quality service in a timely manner.” We take this motto very seriously and truly do provide quality service in a timely manner. Because of this, we have a good reputation with our customers and with upper management. This is not a requirement by upper management, but rather it is our own departmental goal.

Be honest. This is a simple premise and should be a matter of course for all members of a metrology department. When a department member does not know the answer to a question or is unable to solve a problem, he or she admits it and lets the customer know when they can expect an answer. Admitting lack of knowledge will not result in loss of respect among customers, but will enhance respect and credibility.

Maintain professionalism at all times. Be aware that the image you project is very important in the workplace. Always maintain a clean and uncluttered work area. A messy area leads to actual mistakes as well as a perception of incompetence within the customer base. When communicating with customers, always conduct communications in a businesslike manner. No matter what form of communication is used; verbal, memo or e-mail, it is imperative that it is carried out in a courteous, respectful manner.

Safety first! A biotechnology company can be a dangerous place to work. Promega’s metrology department insists on a safe work environment for our personnel, as well as our test standards and the equipment we support. Precautions such as protective garments, gloves and safety glasses are to be used at all times. In a biotechnology company, hazards can be present in the form of chemical and biological contamination. If a piece of equipment is used with dangerous

materials, we require that the user decontaminate the equipment before any calibrations or service are performed.

Employ some method to communicate with your customers, such as the Promega lab liaison program. When a lab liaison is placed in each laboratory, scheduling calibrations and repairs becomes much easier, not only for the metrology department, but also for the people who use the equipment in the laboratory as well. Such a program will enhance the effectiveness of the metrology department.

**Summary:** In this paper I have shown why combining calibration and repair departments into a metrology department is a smart choice for a biotechnology company. I have described the savings that Promega has experienced by supporting our test equipment in-house, and described how we do it. After examining the issues raised, I am sure that the reader will arrive at the same conclusion.