The independent role: verification and validation, and compliance testing

by BARBARA J. TAUTE

Time, Inc.*
New York, New York

ABSTRACT

The independent role of quality assurance can be most beneficial in the final testing phase of the software development life cycle. At this point various efforts and groups merge, often for the first time. The period of time devoted to the discovery, understanding, prioritization, and correction of software problems is critical to the timely delivery of the product. Quality assurance can provide and foster a healthy working environment for this interaction, as well as serve as an intermediary during points of disagreement.

This paper discusses an actual compliance testing effort of customized, complex vendor-supplied software. The value of having an independent group involved during the testing effort was clearly made visible during the arbitration process. The critical timing was monitored, points of disagreement over the contract were resolved, and the testing effort was shortened through the involvement of an independent group. In effect, both vendor and user/purchaser benefited from the quality assurance techniques brought by an independent role involvement.

*This paper was written while the author was employed by Peat, Marwick, Mitchell & Co., New York, New York.
INTRODUCTION

A close interaction between the developer and user is required to guarantee the delivery of data processing software which complies with a given set of requirements. This interaction has classically been a difficult process because of both groups' differing points of view and varying interpretations of the software's requirements. The final phases of the development process, particularly that of testing, can become strained due to the addition of time criticality for system delivery and the stress of interaction between these two groups. This intense testing interaction can be even further complicated in a vendor-contracted software environment in which there is no common ground to resolve the problems. An independent Quality Assurance (QA) Group, whether internal or external to the company, can greatly ease this transition period by laying early plans for the compliance test process, monitoring or assisting in the testing, and acting as arbitrator if difficulties arise.

This paper discusses the specifics of one such testing effort of customized, complex vendor-supplied software and the benefits of an independent QA Group during the verification and validation and compliance (acceptance) testing phases. The independent QA Group was a different company than the vendor or the intended user. The intended user was the purchaser of the package and as such was concerned with its delivery, billing, inventory, returns, terminations, accounts payable, and accounts receivable comprised the various subprograms of the package. Direct general ledger entries were acquired to guarantee the delivery of data processing software, associated systems software, hardware and software maintenance agreements, and the application software package. The package was intended to be turnkey software, but more than 30% of the original code had been changed at the user's request. Further, additional new modules were specifically created by the vendor for the user and added to the system; thus the system approached custom-developed software. The total cost of the system (hardware and software modifications) to date of involvement was $850,000, and the development and initial data conversion effort had thus far spanned a period of two years.

The vendor was implementing the system in a phased approach as shown in Figure 1.

The independent QA Group was requested to give assistance primarily during the major implementation phase, especially regarding specification review and testing assistance. The application package was industry-specific and was to provide an online automatic method of merchandise control. The processes of merchandise ordering, credit verification, delivery, billing, inventory, returns, terminations, accounts payable, and accounts receivable comprised the various subprograms of the package. Direct general ledger entries were

PERCEIVED NEED FOR QA

The intended users of the software package felt they had a need for and initiated the request for the involvement of an independent QA Group because

1. They were unsure of the compliance test process
2. The timeliness of software delivery was critical
3. Communication with the vendor was becoming difficult
4. Staff numbers were insufficient
5. Forms for the new process were not developed

The user/purchaser felt it was important to select a QA Group that was proficient in the independent testing methodology and would be able to assist during the arbitration process, since they lacked this discipline and knowledge in their own shop. From the user's past experiences with this vendor, they had learned that many areas which appeared to be clearly defined in the specifications were confused or misinterpreted by vendor and user alike. During this particular installation effort, the user hoped to avoid these costly misunderstandings by employing a group which would interpret and mediate during the discussion periods. A high level of independence was important to the users because they desired to involve a QA Group which would neither offend the vendor development group nor impede progress.

Whether or not this perceived need justified the involvement of an independent QA Group depended upon the specifics of the environment.

USER ENVIRONMENT DEFINITION

The contracted system was comprised of minicomputer hardware, associated systems software, hardware and software maintenance agreements, and the application software package. The package was intended to be turnkey software, but more than 30% of the original code had been changed at the user's request. Further, additional new modules were specifically created by the vendor for the user and added to the system; thus the system approached custom-developed software. The total cost of the system (hardware and software modifications) to date of involvement was $850,000, and the development and initial data conversion effort had thus far spanned a period of two years.

The vendor was implementing the system in a phased approach as shown in Figure 1.

The independent QA Group was requested to give assistance primarily during the major implementation phase, especially regarding specification review and testing assistance. The application package was industry-specific and was to provide an online automatic method of merchandise control. The processes of merchandise ordering, credit verification, delivery, billing, inventory, returns, terminations, accounts payable, and accounts receivable comprised the various subprograms of the package. Direct general ledger entries were

\[ \text{Figure 1—Period of involvement} \]
to be implemented at a later date. This system (hardware and software) was intended to replace an existent batch minicomputer system; therefore, established databases, expectations of data processing output, and forms of input to the system were already present.

These conditions indicate a fairly complex system. However, the need and level of involvement of an independent QA Group is directed by implementation factors.

ACTUAL NEED FOR QA

The level of involvement of an independent QA Group is dependent upon the program complexity, the user, and the developer. In this type of environment, the involvement of an independent QA Group is essential for the following reasons:

1. Program is extremely large ($850,000 in 2 years)
2. Internal QA group does not exist
3. Software is developed by vendor
4. Time is extremely critical
5. User lacks data processing compliance testing expertise

Any development effort of this size or implementation time is necessarily complex and should have rigorous control mechanisms. A QA Group can assist the effort by early involvement in helping to define deliverables, monitoring the process, and providing testing assistance or acceptance sign off. Ideally, even in internal development, the QA Group should be independent in order to ensure that equally high standards of quality apply to all development groups. For externally developed, vendor-contracted software, the involvement of an independent QA Group is essential. The independent group can help resolve problems and points of disagreement in either party. This can help avoid litigation proceedings. The independent QA Group can help ensure that trivial problems were not lost and provided an identification element for all items. These three deliverables allowed the QA Group to monitor the development effort.

QA TECHNIQUES DEFINED

The deliverables were used to record results of the activities and techniques of the QA Group. The specific methodologies that an independent QA Group can bring to the final testing process are as follows:

1. Progress measurement
2. Test development
3. Problem report control
4. Configuration management

All of these techniques are key to the successful completion of the project and critical during the final testing phase.

Project “Pert” Chart

A scheduled daily chart based upon key items and integration points was established for the testing time involvement. This allowed the progress of the time critical project to be measured and reported to management. Responsibilities, dates, dependencies, and a brief description of the task were included in the chart.

Project Test Plan

A test plan which described in detail the responsibilities and activities of all three parties (user, vendor and independent QA Group) was constructed. In the development of the test plan, the absence of certain testing efforts was discovered, and these were subsequently assigned to individuals.

Problem Report Forms

Problem report forms and summary logs were installed. The problem reports permitted a priority, description, dates, version numbers, and error category to be specified and formally recorded for every “query” about the system. This helped ensure that trivial problems were not lost and provided an identification element for all items.

QA PRODUCT DELIVERABLES

Quality assurance must use a disciplined approach and as such it is important that documentation be maintained to reflect its involvement. The involvement of the independent QA Group, specifically during this testing effort, yielded various deliverables; among them were the following:

1. Project “pert” chart
2. Project test plan
3. Problem report forms

The involvement of an independent QA Group will yield certain deliverables, or tangible evidence of the QA process.
“an accounting nature,” naive operator understanding, ease of use, error conditions, and uniformity were tested by the involvement of the independent QA Group.

**Problem Report Controls**

QA can act as an effective mediator between user and/or vendor during the testing process. For this specific effort, the independent QA Group insisted that formal trouble report sheets be used, priorities be established, enhancements be recognized and as such postponed, approval from the user be given before changes were made by the vendor, and an appropriate retesting cycle established for RETEST.

**Configuration Management**

The knowledge of what is being used or tested is essential to the testing process. During this specific effort, the independent QA Group required that version numbers be placed on every report and screen, the file interaction be made clear (levels of complexity), all subprograms be identified, and the system be tested in a stand alone environment, with no changes during the test process.

These four aspects of test control greatly enhanced the control of the project and were accepted well by the user and vendor.

The actual applications of these techniques will be described next.

**METHOD OF QA APPLICATION**

There were five steps through which the QA Group added value to the effort. These were comprised of the following:

1. Quality assurance review
2. Specification sign off
3. Test plan development
4. Test case assistance
5. Compliance test participation

A quality assurance review was first conducted to establish a base point for the project. The level of involvement of the independent QA Group needs to be modified by the level of testing or assumed responsibilities of the other participant groups. In this effort, the quality assurance review exposed the fact that no project schedule, no test plan, and no contingency plans existed. The development of these was recommended to the user, who developed the documents with QA's assistance.

Specifications for the major phases were close to sign-off when the independent QA Group became involved. Therefore, QA briefly assisted with this effort. The QA Group sat in on review meetings and requested clarification on several points. Because of QA's attention to detail, its direct input clarified numerous vague statements and formulae. Basically, the independent QA Group acquired industry expertise while reviewing the specifications. Thus by initially bringing a naive point of view to the review process, they helped ensure a more product-representative specification. This eventually led to satisfactory specifications sign-off between the user and the vendor.

It was discovered by the independent QA Group that no test plan had been developed for either the vendor or the user. The independent QA Group recommended that a test plan be developed and reviewed by both groups. This clarified the responsibilities of both parties and identified all efforts.

Since the user had not yet developed test cases, the independent QA Group acted in an advisory position and also actually helped develop the test cases. Five increasingly complex iterations were selected as sufficient to prove the acceptability of the software. Test data and expected results were created by the QA Group and user for these five iterations. The independent QA Group also wrote specific tests to detect if invalid entries were being trapped by the system.

During the actual testing, the independent QA Group ran tests by inputting data at the terminal, recording results, and organizing the cycle process. This methodology was used in subsequent RETESTS.

Sufficient errors were discovered to warrant a retest. These errors were prioritized, discussed, and agreed to correction by both parties, with the independent QA Group acting as mediator. The QA Group provided a very useful function as mediator, because it allowed both user and vendor to vent their feelings. After the discussions, the QA Group would help find a “best-fit” answer.

From the comments by both vendor and user, it was obvious that the QA Group role was effective and perceived to be beneficial by both parties.

**EFFECT OF APPLICATION**

Any interface has both positive and negative effects, and so did the involvement of the independent group in this effort. Overall, the benefits of the QA Group's involvement far exceeded any negative aspects, and the entire effort was seen as productive.

Some of the benefits included the following:

1. Security
2. Role definition
3. Information transfer

The development of plans and schedules assisted the effort by giving guidelines and the ability to measure progress. The user group thus felt there was direction to the installation process, and they had a tangible means of relating to the effort. Also the user had a basis to report progress to upper management. This measurement gave them a good feeling of security.

Role definition was made possible by assigning the identified tasks to specific individuals. Thus, on an individual personal basis, people knew their activities to achieve the desired results.

Most important, information was transferred among all parties. This yielded a better understanding and increased appreciation for each other's jobs. More than anything else, the transfer of information yielded greater system satisfaction by
the user. Also, the vendor gained knowledge of the user's environment that would prove useful in future modifications to the system.

However, the involvement of an independent QA Group was not entirely positive. Some of the negative aspects of the QA Group involvement are the following:

1. Cost in dollars
2. User dependence
3. Group qualifications

The role of the independent QA Group can be expensive, depending upon their level of involvement. In this specific effort, multiple tasks were actually done by the QA Group instead of the user. Some of these tasks (test data preparation) could have been completed by the user had there been sufficient staff. The QA Group could then have done a management or monitoring of the process rather than actual participation. The degree of actual involvement by the QA Group will vary, depending upon the tasks which can be done by the user group. Therefore the user should be made aware early of the QA Group's responsibilities and activities in order to plan for possibly less expensive alternatives or to allocate budget for the effort.

Another problem in the involvement of an independent QA Group is the eventual user dependence on the group. In this specific effort, because of the depth of QA Group involvement, the user relied upon the QA Group to act as an intermediary and in many cases desired that it authorize changes to the system. The QA Group should never do this, because it will possibly lose its independence. QA should act as an advisor or mediator only in this role; and if they feel the user is relying too much on them for direction, the QA Group should seek to correct the problem.

The final problem of group qualifications is one which will affect many efforts. When one searches for the best group to function in the independent QA role, a select set of characteristics emerge. In this specific effort, the independent QA Group lacked industry expertise (this lack, however, was turned positive through naive testing). Although not all characteristics will probably be found in a candidate group, the following (in decreasing order of priority) should be weighed:

1. State-of-the-art quality assurance views
2. Multiple-level testing experience
3. Maintenance program responsibility experience
4. Applications systems development experience
5. Specific industry expertise

These should help determine the group with the "best fit" for the job.

SUMMARY

An independent QA Group is invaluable in the verification and validation, and acceptance test process. QA can fulfill the functions of mediator, director, advisor, and participant. These functions are especially needed in a vendor-supplied, complex software environment in which the user/purchaser and the vendor may clash during the final testing phases. The user and the vendor represent different disciplines and necessarily differing points of view. Most important, through the use of an independent QA Group, communication between these two groups can be greatly improved, and the delivery of a more functional system can be aided.

At its best, the QA Group can assure a trouble-free, well controlled acceptance of a jointly agreed upon system. At its worst it is a costly, dependency-inducing process. In any case, both vendor and user have much to gain by the involvement of an independent QA Group.