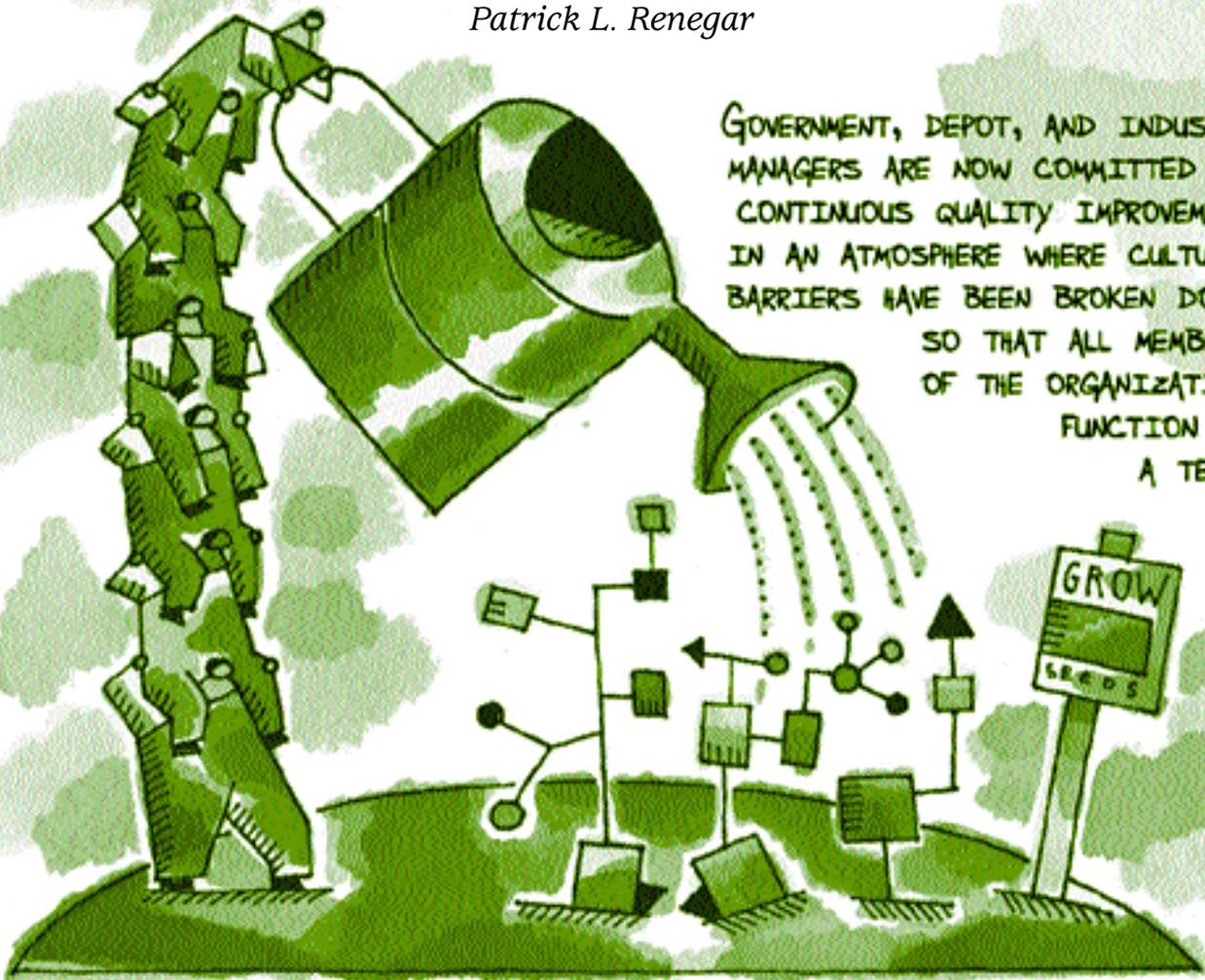


# The Challenge of Producing Quality Materiel in an Environment of Reform

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GOVERNMENT, DEPOT, AND INDUSTRY MANAGERS ARE NOW COMMITTED TO CONTINUOUS QUALITY IMPROVEMENT IN AN ATMOSPHERE WHERE CULTURAL BARRIERS HAVE BEEN BROKEN DOWN SO THAT ALL MEMBERS OF THE ORGANIZATION FUNCTION AS A TEAM.



**B**eginning in the 1990s, in the throes of declining military budgets, the Department of Defense (DoD) embarked on a series of reforms to streamline the military acquisition system. These reforms, known as the Perry Initiatives, involved sweeping cultural changes with the intent of reducing acquisition time and costs. At the core of the change was a major refocus in the way the DoD manages its acquisition programs. This change shifted much of the burden for development and production of weapon systems from the government to the contractor. In the new culture, the government was to provide the contractor with a performance specifica-

tion, and the contractor was to determine how best to develop and produce the item. Streamlining also did much to encourage innovation within the development and acquisition process, which seemed to be entrenched in a myriad of specifications.

## **The Downside of Acquisition Reform**

Acquisition reform had some unintended negative consequences, however, including the elimination or major reduction in the role of the quality discipline on military hardware production programs. During this same time, contractors found themselves in the midst of mergers,

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acquisitions, and consolidations. These actions significantly impacted how business was to function, as each company had to redefine its corporate culture and the area in which it would conduct future business. Budget cuts also led to significant changes within the government depot support elements as they found that it would be necessary to increase their business in order to survive. Competing for business was a major cultural change for the depots. They had little experience at the task of building a business base and were not staffed to support such functions. Government program/project offices were also impacted in that reduction-in-force targets were also levied on their operations.

As a result, all were forced to look at their internal operations and eliminate areas that were considered wasteful or non-value added. This is a desirable consequence but is often practiced with short-term goals in mind (focus on today's problems with little or no concern for the future). In addition, many older, experienced workers, including management, retired during this same time period (in some instances as the result of financial incentives) and weren't replaced by younger workers because of budget pressures. Hence, when less experienced workers were eventually hired, there were fewer experienced workers remaining to provide on-the-job training and to pass on lessons learned and legacy corporate/program knowledge. Furthermore, formalized training budgets reflected the overall reduction in spending, and new hires were not properly equipped to support all work planned by management. This personnel problem was further aggravated by the difficulty in hiring persons in an industry highly publicized to be in a state of decline. Lastly, alongside corporate cutbacks, confusion surrounded the nature of the new leadership role for government quality assurance (QA) organizations. Their hallmark surveillance and oversight functions of the past were severely curtailed or, in some instances, eliminated.

### **QA Suffers**

While well-established quality programs may have existed, they were deflected from their traditional practices by major internal business changes, and the quality systems didn't keep pace with the demands that were made on them. The mantra was that quality was inherent to everyone's job. One consequence was the decline of the practice of QA activities and the associated decline in the QA profession in the industry. The presence of extensive local government oversight and direction was viewed to be a significant cost driver. It seemed reasonable, therefore, to place the responsibility for developing materiel in the hands of contractors as long as they understood the performance specifications and were operating with the principles of ISO 9000 quality assurance and quality management standards. Indeed, in an ideal world that conforms to theory, design engineers develop requirements-conforming producible designs, then flaw-free products

are made by production organizations without the need for any oversight. However, history has shown that the real world does not conform well to ideals and ultimately reaches a steady-state operating point at its lowest common denominator. Unfortunately, this occurred and largely because many contractor quality organizations still looked to the government for leadership, reinforcement, and a new way of imposing the governing and controlling standards and specifications. Blurring the role of quality by reform initiatives resulted in both government and industry waiting for the other to act.

### **Outsourcing Creates Issues**

Another change in the method of conducting business has been for defense prime contractors to outsource items previously designed and manufactured internally. While this may be more efficient from a cost perspective, the management of many subcontractors further complicated the quality process and compounded the quality problems described above. First, many subcontractors consider their products and processes proprietary and resist outside oversight, whether from the immediate corporate customer or from the government. Their specific designs also are often considered proprietary. Hence, the customer is buying "black boxes" without knowing the contents. In several instances, the use of commercial off-the-shelf (COTS) items was directed by the government as a cost saving measure to provide current technology to the field. In these instances, customers had to rely on the integrity and technical maturity of the subcontractor organizations and the diligence of the system prime contractor to control them. This premise often failed, as the COTS supplier was not receptive to any controls, and product was provided on an as-is/take-it-or-leave-it basis.

For many reasons, contractor oversight and control of subcontractors weren't adequate, and problems resulted on several occasions. For example, vendors made changes to approved and frozen designs without prime contractor or government knowledge or consent, independent of the potential downstream impact of the change. The flow-down of design guidelines and prohibitions required by the system specifications or scopes of work didn't or couldn't take place. This resulted in the inconsistent management of subcontractors, which, in turn led to delivery of nonconforming or non-useable supplies.

Further, contractor organizations didn't place an emphasis on continuous quality improvement. "I meet the requirements of ISO 9000 as demonstrated by my certification," was the attitude. Unfortunately, product and process quality will always be in motion, either in an upward or downward direction, and must be understood and managed for proper control. To further illustrate this issue, metrics used by senior leadership as management indicators had migrated to a level too high to provide sufficient information in a timely manner to indicate prob-

lem areas. While overall company status may appear healthy, specific elements may in fact be in trouble. Neglect of this fact has led to deterioration of product.

### Wait and See

All through the turbulence and uncertainty of corporate mergers and the adaptation of standards that did not mirror past government quality practices, government program organizations remained passive. Throughout the period, they shifted their focus from hall-marked surveillance and auditing to wait-and-see, instead of presenting a challenge to industry to demonstrate how quality product was to result. In essence, the dynamics of change impacted everyone. From the initial shift in responsibility for implementing standards at the start, to what were the acceptance requirements at the end, everyone's role was certainly blurred.

### A Case in Point: The PATRIOT

The experience of the PATRIOT missile system illustrates the erosion of quality since the beginning of acquisition reform. PATRIOT serves as a good example because it experienced all phases in the acquisition life cycle concurrently (i.e. PATRIOT had fielded legacy elements as well as portions in research and development (R&D) and production.) In the 1990s, after Operation Desert Storm, the PATRIOT system underwent a major product improvement that was subject to the full impact of acquisition reform: development and purchase of upgrades to the PATRIOT ground hardware, including spare parts; development and production of the PATRIOT Advanced Capability-3 (PAC-3) Hit-to-Kill Missile; and refurbishment activities for legacy PATRIOT Missiles. All prime contractors and one government depot support element involved in these programs were examined. All three organizations had established ISO 9000-certified quality management systems.

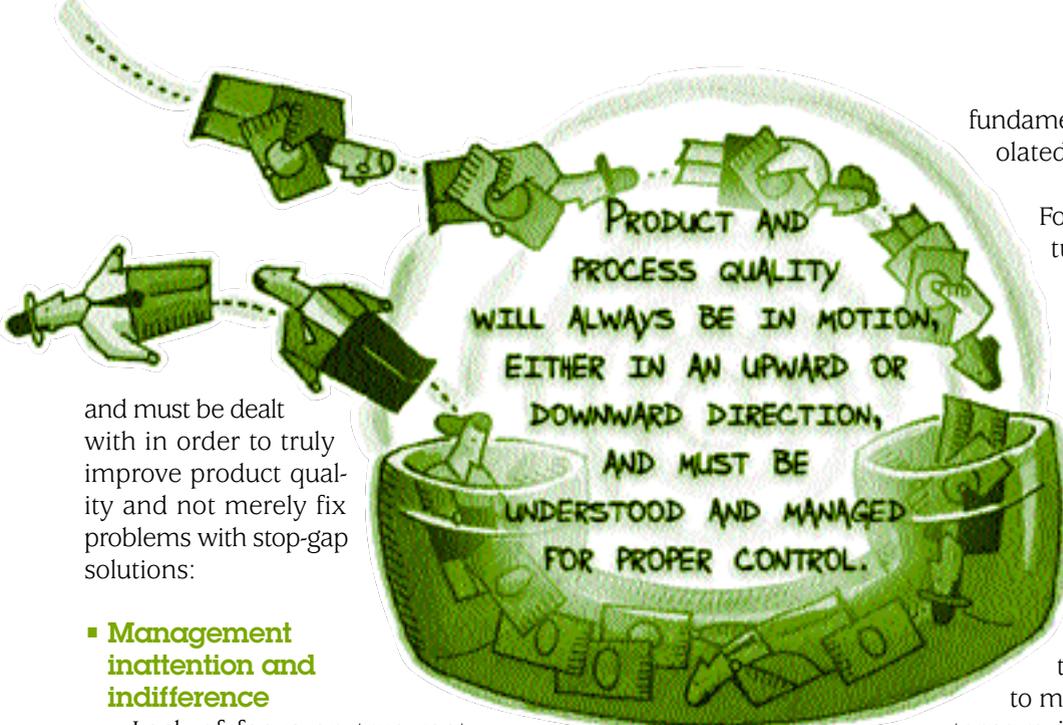
Documents prepared by each of these three organizations from August 2002 to the present were analyzed. The purpose of the analysis was to determine whether any common threads existed among the organizations that might cause the quality issues being experienced. The analysis process included steps to determine what caused specific problems and how the problems were managed. The documents dealt with specific quality issues that were identified by various Aviation and Missile Command (AMCOM) and contractor organizations. The sidebar at the top of the next column summarizes the issues and the specific quality fundamentals violated or diminished.

## Systemic Quality Issues Impacting PATRIOT Systems

Quality Fundamental	Violation
<b>Policy, Planning, and Management</b> <ul style="list-style-type: none"> <li>• Defines and enforces quality policy and objectives</li> <li>• Evaluates quality metrics</li> </ul>	<ul style="list-style-type: none"> <li>• Quality policy and planning not kept current with business environment</li> <li>• Change in metrics resulting from growth/change in base business</li> </ul>
<b>Design Assurance and Design Change Control</b> <ul style="list-style-type: none"> <li>• Identifies document and flow design input requirements</li> </ul>	<ul style="list-style-type: none"> <li>• Systems engineering process not properly practiced/utilized</li> </ul>
<b>Control of Purchased Material</b> <ul style="list-style-type: none"> <li>• Verifies the flow-down of requirements and instructions to subcontractors and vendors</li> </ul>	<ul style="list-style-type: none"> <li>• Self-inspection/audit programs not properly implemented</li> <li>• Improper use or lack of use of statistical signals of problems</li> <li>• Dock-to-stock programs resulted in production stoppages, material purges, and field failures</li> </ul>
<b>Production Quality Control</b> <ul style="list-style-type: none"> <li>• Assures the control of manufacturing through inspection, testing, and metrics</li> </ul>	<ul style="list-style-type: none"> <li>• Self-inspection/self-audit programs improperly implemented and managed</li> <li>• Top management visibility clouded</li> </ul>
<b>Corrective/Preventive Action</b> <ul style="list-style-type: none"> <li>• Investigates the root cause of nonconforming product</li> <li>• Develops actions to prevent recurrence</li> </ul>	<ul style="list-style-type: none"> <li>• Improper management or lack of an efficient closed-loop root cause corrective action system</li> </ul>
<b>Employee Training, Certification, &amp; Motivation</b> <ul style="list-style-type: none"> <li>• Verifies that employees are properly trained</li> </ul>	<ul style="list-style-type: none"> <li>• Improper management of resources</li> <li>• Ripple effect to workforce of government and industry reductions in force</li> </ul>

The actual incidents recorded ranged from missing hardware, to foreign object debris, to not following documented manufacturing and quality procedures. Numerous failures escaped the manufacturing facilities and were found in the field. In fact, the manufacturing line was completely emptied of a particular part in order to support ongoing field activities. It is interesting to note that none of the problems observed was a high-technology problem. Relatively fundamental documentation or process miscues created problems with low-technology items. Taken as a whole, though, they are indicative of something systemic in nature. That is, each of the miscues could have been avoided had there been a management commitment to continuous process improvement and had fundamental principles of quality assurance been practiced. None of these issues, in isolation, would be earth shattering; however, in the aggregate, they are alarming and unacceptable.

When the specific problem areas were examined, several common threads emerged. They are the underlying causes



fundamental element of QA has been violated.

Fortunately, the problem is being turned around. Operation and materiel quality is improving. Innovation and efficiencies are encouraged while product quality is maintained. Every problem area is being examined to determine what in the acquisition culture has allowed such quality deficiencies. Government and contractor alike have committed to do whatever it takes to ensure that deliveries meet requirements. Initiatives made by the government to meet these challenges include intense review of product failures to ensure

and must be dealt with in order to truly improve product quality and not merely fix problems with stop-gap solutions:

■ **Management inattention and indifference**

- Lack of focus on true root cause but focus instead on the immediate, short-term corrective action
- No or ineffective internal auditing
- Non-closed-loop corrective action system
- Inadequate company quality policies or failure to enforce policies
- Lack of quality control director equal with other discipline's directors

■ **Lack of information transfer**

- Inadequate requirements flow-down
- Inadequate documentation flow-down
- Inadequate work instructions
- Inadequate technical data packages/manufacturing data packages
- Inadequate or lack of training

■ **Ineffective quality metrics**

■ **Lack of Vendor/Subcontractor oversight/control**

■ **Lack of commitment to continuous improvement**

■ **Departure from sound fundamental quality/product assurance principles.**

The common threads above are symptomatic indications that the strong government program office of the past, with its clearly defined responsibilities, no longer held current operating agents (contractors, depots, and government organizations) accountable. This led to the many manifestations of quality decline that have been seen.

**Future Solutions**

The major changes in the acquisition culture, combined with the degradation of quality and quality management systems, have been a slow migration. While there were no direct acts on the part of government or contractor management to minimize the importance of quality, it has occurred nonetheless. Though varying in extent, every

identification of root cause and the implementation of robust corrective action and restoration of quality. In essence, the fundamentals of quality have been reinstated in the contractors' and depots' development and production processes.

A number of activities that have been shown fruitful in assuring root cause and robust corrective actions :

- Strong executive leadership involvement
- Strong day-to-day participation by the government and contractor QA function in the integrated product team (IPT) process
- Strong emphasis in the IPT process on failure review board and root cause and corrective action activities
- Integration of the government quality assurance function in the identification and resolution of quality and manufacturing systems
- Return to the practice of the systems engineering process and sound fundamentals of quality and manufacturing.

Other solutions emphasize a back-to-basics approach. Continuous improvement and reduction in defects are being emphasized as part of the quality program. Contractors are establishing, re-establishing, or confirming proper documentation baselines for the entire technical and manufacturing data packages. Contractors and government depots have reinvigorated the root cause analysis process leading to proper corrective actions. The elimination of root causes is focusing beyond the immediate technical solution into the culture that encouraged the technical problems in the first place. In other words, the failing within the culture that fostered or encouraged the quality escape is being identified and corrective action is applied as necessary. In all cases below, executive-level sponsorship is now demonstrated.

■ **Management inattention and indifference**

- Encouraged manufacturing employees to stop what they were doing, and to identify, fix, and prevent problems as early as possible
- Initiated stop-gap corrective actions to prevent escapes
- Maximized ship-readiness and preventative actions
- Emphasized continuous improvement, control, and sustainment.

■ **Lack of information transfer**

- Demanded a quality first mindset from all personnel
- Initiated intensive employee training programs sponsored by senior executives
- Identified failure of corrective action systems (i.e. ineffective or lack of root cause identification)
- Restructured/re-energized the Corrective Action Board with senior management participation mandatory
- Took corrective and preventative action for all quality indicator findings rather than reviewing only the metrics that did not meet a set goal.

■ **Ineffective quality metrics**

- Instituted improved measurement and reporting system of quality performance indicators with bottoms-up instead of top-down review at every level.

■ **Lack of Vendor/Subcontractor oversight/control**

- Reassessed/revised supplier practices and ground rules
- Identified and assessed program-significant suppliers.

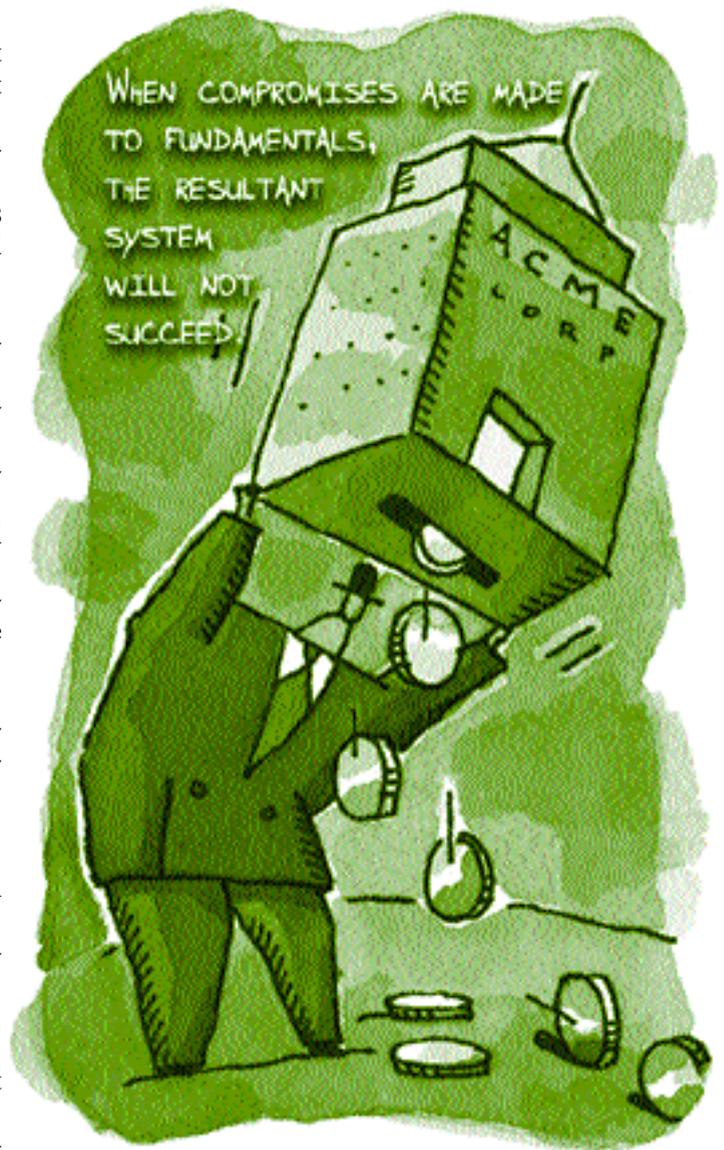
■ **Lack of commitment to continuous improvement**

- Reasserted commitment to continuous improvement
- Took proactive approach to problem solving
- Focused on setting clear goals and correcting systemic issues to improve process performance and product quality.

■ **Departure from sound fundamental quality/product assurance principles**

- Developed policy, performed planning, and provided management attention
- Provided adequate and proactive design assurance and design control
- Instituted control of purchased material
- Introduced proactive production quality control
- Performed root cause/corrective action
- Provided employee training, certification, and motivation.

Government, depot, and industry managers are now committed to continuous quality improvement in an atmosphere where cultural barriers have been broken down, so all members of the organization function as a team and remain true to the fundamentals of quality assurance as an overriding purpose. This new teamwork between government and industry was, in fact, the hallmark of the



original acquisition reform. The lesson learned is that all government and contractor employees are empowered to contribute to continuous quality improvement to ensure that deliveries meet requirements. The government and contractor project team is committed to the fact that quality and reliability must be planned for and appropriately budgeted; they cannot be bargaining chips and their levels cannot be compromised. Regardless of the quality system implemented or the acquisition policies in place, a sound quality and manufacturing system is based on sound fundamentals. These fundamentals are proven and do not change. When compromises are made to fundamentals, the resultant system will not succeed.

**Editor's note:** The author welcomes comments and questions and can be contacted at [pat.renegar@cas-inc.com](mailto:pat.renegar@cas-inc.com). The author acknowledges contributions to this article from the following: Army Lt. Col. Barry G. Manning and Michael R. Whitt, Lower Tier Project Office; and Steven Junkins, CAS, Inc.