From: William Livingston [vitalith@earthlink.net]

Sent: Friday, November 21, 2003 7:33 AM

To: Comments

Subject: PCAOB rulemaking docket matter No. 008

Office of the Secretary:

In your PCAOB Release No. 2003-017, October 7, 2003, you proposed an Auditing Standard governing attestation engagements, referred to in the Sarbannes-Oxley Act of 2002, and requested comments from interested persons. I am a registered professional engineer (PE) and a member of The Institute of Internal Auditors (IIA). There is keen interest in the official response aimed to "deter" the process by which The Class of Enron managed to implode our 401K retirement accounts while so very many professional and fiduciary watchdogs were on duty. The trillion$ are long gone: the watchdogs remain employed.

Representation

The comments herein originate exclusively from the professional practice of engineering, without condition or disclaimer, representing the profession's standard of care and conditions of the PE license. These functional perspectives are independent of any official position of the IIA and do not represent any IIA views concerning your release. The material differences in the frameworks of professional practice between engineering and internal auditing (a primary basis of your proposed standard) structure this commentary. The assessment work was paced by the Attribute and Performance Standards (IIA Professional Practices Framework 09/03) and IIA Practice Advisories for an attest engagement regarding PCAOB assertions. The assessment had to stop short of the level of detail questions listed in your release after determining an overriding mismatch of methodology to purpose.

The Professional Engineering benchmark

The profession of engineering operates to a venerable code of conduct, little changed in the last century, with significant obligations to society unlike those demanded of any other licensed profession, including law, accounting and internal control. The professional engineer is duty bound to hold the public health, safety and welfare paramount. In the rules of action to meet this responsibility, the professional engineer is required to detect incipient program misalignment with the stated objectives and warn the designated authorities "up the ladder." The reliable determination of impending (future) failure to meet the schedule, budget and results specification obliges the PE, upon completing warning duty, to withdraw from the project. The proactive duty of the PE is focused on prevention and avoidance, not confined to reacting to the events of damage. The very presence of a professional engineer on a project is taken as assurance of a successful goal-seeking enterprise.

Since no excuses are permitted, failure to deliver on the pledge of damage preemption is not an option. The fact of damage itself is sufficient to establish dereliction of duty. The professional engineer, grounded in the myriad laws of nature and trained to leverage them to good purpose, cannot blame failure on the moral or ethical shortcomings of others. There is no "inherent limitations" escape hatch out of the pledge to public welfare - and for good reason.

The no-excuses, no-escape mandate, oblivious to the ethical makeup of the participants, has long been accepted by the engineering profession because, simply, there is no other viable way in the rule of law to preserve society. We live in a world that is designed. The context within which society functions is largely composed of engineering artifacts - the material proceeds from the process of engineering. Who but the designers could rationally take the blame for the consequences of design? The mandate issue resolves thereby entirely to the extreme intellectual demand, necessary and sufficient, to select action appropriately in mind-numbing complexity.

The Orders of Magnitude guideline

Set one (1) as the value of the intellectual investment necessary to "experience" an engineering artifact, such as riding as a passenger in a car. Judgments are made in the experiencer situation by individual instincts and feelings. The successful "operator " of the car must invest at least ten (10) intellectual units to be a provider of the dynamic automobile experience (1). The successful "maintainer" of the car must invest an order of magnitude more (100) in knowledge acquisition than the operator (10) about the systems comprising the car and their interaction dynamics in order to diagnosis, repair and restore operational functionality of the vehicle. The car "designer" engineers must each make an intellectual investment of at least a thousand units (1000), an order of magnitude greater than the maintainer (100). The scope and depth of knowledge necessary to appropriately select that which will comprise an automobile satisfactory for its market in future time is daunting. Shannon's tenth theorem allows no wormhole for professional judgment to reduce the quantity of knowledge necessary for appropriate selection to take place.

Internal auditing is subject to the same scaling factors. The designer of the internal control system must possess far more knowledge than its operators. This demand is emphasized several places in the PCAOB standard. If the auditor of internal control is to serve as benchmark and design basis for meaningful tests and walkthroughs, for example, he can know no less than the designers of the system. Conclusions of the attestation require the support of reason. In practice, this is more than a formidable task. Until the requisite knowledge is developed and organized, the lists of criteria to apply to it must remain dormant.

Complexity Management

The process of engineering is a systematic assault on complexity - completely, rigorously and scrutably connected to natural law. Engineering design is dealing with the future in knowledgeable anticipation of the dynamics that produce both benefits and consequences. Since damage avoidance is a central concern in the process of design, the intellectual demand for damage preemption is at least three orders of magnitude higher than that for damage response. The enormous differences in task complexity between responding to damage and preempting it require different methods. Since the frame of reference for the comments, required for professional engineers, must be prevention, avoidance and preemption, there is an inherent conflict with the basis for all rules of action, the essence of regulatory agency - damage response. Nothing in the realm of damage response translates forward to the duty of damage avoidance. It is essential to recognize the incompatibility between the activity package commensurate to the line of time past (analysis) and those activities of synthesis effective with deciphering the expanding cone of the future, which is, exactly, the only place where goals are attained and ethics assigned.

The social controls context

The distinction between prevent and remedy values, between analysis and synthesis, is vividly reflected in the striking difference between how society rewards and honors the heroes who rise to the crisis occasion and how it ruthlessly punishes the preemptive whistleblower. The corporate budget, along with this PCAOB standard, clearly reveals the full allocation of resources to damage response at the expense of damage prevention. Cultural bias in resource allocation, favoring damage response, is the gateway for fraud.

The hostility to damage preemption is connected with society's instinctive loathing of the process of engineering. Regardless of society's addiction to engineered artifacts, the process of engineering and, by association, its practitioners, reside in the bilge of necessary evils. From ancient times to this day, the process of engineering (synthesis) has been considered a threat to social order with its despised practitioners, called nerds, mavericks and eggheads, to be obstructed, ridiculed and persecuted. No great encyclopedia, resplendent with the various specialties of science (analysis), by design, contains a section on engineering.

The long history of the struggle between the professional obligation to avoid damage and the extreme social prejudice for damage responding is fully captured and revealed in The Professional Practices Framework published by the IIA. The profession of internal auditing has sixty years of hard experience in the front lines of this fundamental conflict between incompatible method systems. There is nothing attempted or contemplated by the PCAOB in rule-based regulation that does not already have a rich precedent history in the IIA archives. While it is essential to accommodate the extreme cultural bias against preemption as a given, more viable avenues of influence have become available. The significant new workable factor impinging on the internal control affair is the great step increase in the capabilities of damage avoidance that has already occurred - through persecution, prejudice and all.

Significant note

While the march of science and technology has done little to alter the realm of rule-based operations (analysis), professional engineering owes you the duty of notification that the zone of effectiveness of the process of engineering (preemption) has, in the last few years, made a quantum leap far into the operational reality. The increase in complexity now within the scope of engineering design (synthesis), which is to say damage avoidance, is so large it has forever altered the working definition of key terms, such as "reasonable," in the legal and regulatory spheres. That which was computationally impossible in 1998 has already become routine engineering design practice. All the borders of the classical constraints to practical risk mitigation are being moved, ready or not, by advances in the process of engineering.

Whereas engineering methodology in use today was completely defined and scientifically validated by 1960, it took the relentless, exponential growth in computer power (Moore's Law) to successfully assault the quantities of complexities common to the systems of our daily experience. The process of engineering engages the extreme complexity of preemption through the use and control of intelligence amplification, an exact parallel to power amplification. Intelligence amplification (IA) is a three-step process by which the power of appropriate selection is increased significantly beyond the intelligence of the human operator who executes that process. One example of manifest IA is the cell phone. In operation, it consumes the equivalent intelligence of 80,000 coordinated "brains." Through IA, engineers are not limited in performance by the capacity of their own brain to process the information necessary for appropriate selection.

The market explosion in "intelligent machines" is directly proportional to the rate of growth in the basic competency to avoid damage. The two activities, design and preemption, are one and the same thing. For all practical purposes, today, there is nothing in the future of an engineered artifact that is not foreseeable (as in tort negligence) - in the context of practical and timely. In like manner, through the damage avoidance competency of the process of engineering, internal control need not be "subject to lapses in judgment and breakdowns resulting from human failures." There is no need to accept the "risk that material misstatements may not be prevented or detected on a timely basis ..." There are no inherent limitations.

For the purposes of the PCAOB, it is much more important to first recognize the inherent constraints in your basic approach to the SEC assignment as a prerequisite for "release" to detail. Like Pandora's Box, once released, you can't get the menace of unintended consequences back in.

The limits of regulation

The central law of nature that governs the performance of internal control is - control theory. This natural law ranks in significance with and combines seamlessly to the second law of thermodynamics. Control theory constrains the effectiveness of the rule-based regulatory process, as in the PCAOB, in fundamental ways. Managing operations by compliance to rules automatically eliminates the factors of mission objectives and process consequences in selecting task action. When activity choice is fixed by rules, loyalty is measured by obedience to the rules - and nothing else. When the context is appropriate for rule-based governance to be effective, it is also economically efficient.

The limits to the beneficial effects of rule-based governance are set by control theory - and nothing else. By its definition, a rule of action cannot call for replacing itself when events render it no longer producing satisfactory outcomes. If you design a rule that orders its own replacement when better goal-seeking activity emerges, you have not created a rule but a variety of engineering process. You can either specify the action to be taken, Aristotle's "efficient cause," or you can specify the results, goals and objectives to be attained, Aristotle's "formal and final cause." Control theory forbids specifying both simultaneously. You can choose to specify both, as you wish, but the effect that you cannot alter is to destabilize the proceedings and destroy productivity on all counts.

As a rule maker, the PCAOB cannot issue a rule which includes a responsibility, for those faithful in compliance with said rule of action, for any outcome aligned with your commission. Issue your rules, as you must. Enforce compliance, as you must. What you cannot do is transfer the functional responsibility for rule-compliant outcomes. When fraud evades the internal control system you designed, no big trick, the responsibility is yours. Oversight by hindsight is not kin to the insight of foresight.

Deaf to persuasion, control theory inserts an inflection point in the curve of productivity versus context for rule-based governance that does not exist for the process of engineering. When the context positively favors rule-based management, such as in a steady, repetitive business environment, as Henry Ford knew, more and better rules translates directly to more productivity. When the context turns toxic to governance based on rules of action, such as frequent intrusions of complexity and novelty, the inflection point will be breached. In mindlessly applying the same strategy when on the negative side of the inflection point, more rules immediately become grossly counterproductive. Because of this dramatic reversal in the sign of influence, it is the duty of every professional to be acutely aware of the point on this continuous curve occupied by his engagement. In practice, the determination of status of an engagement on the curve is simple and reliable. It is humanly impossible to mistake a situation on the positive side for one on the negative side. All red flags are flying vigorously in the same direction. To continue to apply standard procedure on the negative side of the inflection point, oblivious to the attending counterproductivity, is an error of principle.

Initialization requisites

The professional engineer, executing the process of engineering, must take two steps in initializing his engagement that are invariably omitted in rule-based practice. The very first task is to quantify the complexity entailed in the assignment. This is done by counting the number of relationships that comprise the field of knowledge from which appropriate selection must be made. It is the quantity of complexity, and nothing else, that determines which of the two possible strategies of control to apply to the assignment. When the field of ignorance is large, habitually and grossly underestimated, there is no alternative for the professional engineer but to engage intelligence amplification. The quantities of complexity grow exponentially with numbers of elements and relationships. In many cases of interacting systems, there is another exponent to the exponent. In the context of relatively small business organizations, the number of possible unique domain variations (the basis of appropriate selection) often exceeds the number of atoms in the universe.

The quantity of complexity residing in the engagement directly brackets the possible contribution of "professional judgment." Without doubt, when the quantity of engagement complexity is reasonably close to human capacities, professional judgment is a splendid, safe technique to improve productivity. Quite correctly, you require a reasonable basis for reliance - evidence - a rationale for forming an opinion, the trail of logic for assessment of design effectiveness. These assignments require knowledge development and, required by the Second Law, the imposition of coherent structure.

However, when the field of ignorance is very large and available information is error-laden, asking professional judgment to make a difference is, in effect, turning honest men into public liars. When the auditor is required to "understand how internal control over financial reporting is designed and operates to evaluate and test its effectiveness," and the quantity of complexity intrinsic to the system is sixty orders of magnitude higher that his intellectual capacity, it is the pursuit of the impossible. This affair falls under the absolute dominion of Ashby's Law of Requisite Variety - "Only variety can destroy variety." To legitimize an impossible auditor work context is bad news for stakeholders.

The second initialization step required of the professional engineer is to determine the "quality" of the information and data going into the business systems. There is no such functionality as "control" or "regulation" without incorporating the quality of the input data associated with the data itself as part of the computations. Any assumption of variable data as eternally "good" is professional malpractice. Recent published studies by the vendors of business software to support SEC compliance show that the data processed by organizations for compliance typically run between 10% and 30% defective. This finding is entirely consistent with the industrial process control experience involving physical instrumentation. It takes a great amount of diligence and focus to identify and label the quality of input data on a real-time basis for the purposes of dependable, robust control. The chore to systematically develop knowledge about the frequency, cause, impact and an appropriate response to data quality defects always pays off in prompt detection of serious system malfunctions. To bypass the labor of dealing objectively and thoroughly with information quality is a technical error with material consequences.

There are many more ways for data to be defective than to be good. Information can be missing, late, wrong units, wrong sign, mislabeled, out of plausible range, inaccurate, displaced, etc. Calculations that need to be synchronized, such as for periodic financial statements, present yet another dimension for errors. The requirement to address the information quality matter, as a tag that accompanies the data, is a prerequisite to the design of a control system that can deal with defective input information and, by diverse redundancy, still maintain satisfactory control up to a computable degree of quality degradation.

Displaced, misplaced supervisory control

The institutional response to the damage caused by the class of Enron includes a refocus of the responsibility for such damage in the future up the hierarchy to executive management. In the context where the quantity of complexity and its field of ignorance is huge, this direction is opposite to the supreme principles of control theory. Increasing the number of supervisory levels between the work face and the responsibility for workface results increases the time lag between creating the damage and responding to it. Increasing opportunity time for fiscal mischief elevates the risk of system instability, including scandal, litigation and bankruptcy. Fixing clear responsibility for the rule-augmented damage, in advance of its occurrence, may temporarily attenuate some stakeholder wrath, but this political expedient comes at the price of increased damage to the public. It is only a matter of time. The core issue remains unaddressed.

Avoiding the consequences

Damage preemption as delivered by the process of engineering is a byproduct of activity regulation at the workface. The time lag between error generation, taken as a given routine of the operational reality, and error detection, taken as a shared obligation of the work crew, is reduced towards zero. In the process of engineering, error at the work face appears as just another disturbance to goal-seeking activity to be compensated along with all the other disturbances, by knowledge-driven (designer grade) mid-course corrections. No problem. With every member of the workface crew an equal-opportunity preemptive whistleblower, the regulatory process involving human diligence and compliance cannot be intentionally circumvented. In this workface crew context, fraud appears simply as yet another disturbance to be promptly remedied, rendering material fraud impossible. Intentions, morals and ethics of the workers are incidental attributes. No excuses.

When responsibility is administratively separated from the work face, the work crew standard of care forcibly locks in to brain-off, rule- compliance mode and the cause for damage preemption is lost. The disconnect and remote location of workface product responsibility is the reason you include "Inherent Limitations In Internal Control Over Financial Reporting."

Conclusion
In my professional judgment, readily validated by independent audit, rule-based regulation of internal control has already migrated well past the productivity/context inflection point and that both the regulators and the regulated are highly aware of that fact. Collectively, this aggregation of connected systems of control and regulation is deterministic. Given the status assessment described herein, any professional can confidently predict the future. These warnings satisfy the PE obligation.

The opportunity to provide commentary to the PCAOB in this convenient format is greatly appreciated.

William L. Livingston, PE