Organizational Problems: Potential Causes and Unintentional Consequences — Some Personal Views

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It is not uncommon today for companies to suffer a range of program difficulties, which broadly lie under the headings of "lack of efficiency," "schedules moving to the right," "cost overruns" and "having to repair past poor decisions." Although senior management may appear to be well aware of these problems and their consequences, inherent difficulties in rectifying these problems exist. Often, responses are more directed to corrective action and damage limitations rather than assessing what is wrong at a fundamental level. Of course, most — if not all — safety mishaps can be associated with technical or human faults. However, it is also generally accepted that these are not the root-cause reasons for mishaps but rather, a result of faults higher up in the organization's structure.

Organizational approaches to their operations change with time. These changes are, on the surface, based on sound reasoning, but they should always be scrutinized to ensure they do not fall foul of the "law of unintentional consequences." This paper examines this idea, including where such potential dangers need to be identified at an early stage and suitably managed. Yet, early identification of such potential dangers and their eradication is by no means a simple task.

This paper identifies and discusses the possibilities for unintended consequences, which may play a significant role in root-cause contributions to ensuing problems. Often, organizations see the need to rectify emerging problems through better program, project and financial management, as well as through organizational changes. However, one might speculate that this is a process which is directed towards minimizing damage arising from poor earlier technical decision making rather than to "bite the bullet" and go back to rectify previous decisions made by the organization. One may well ask whether an organization will become permanently trapped in the urgency of having to deal quickly with a series of crises as they arise. Will the organization merely respond with the appropriate "sticking plasters" rather than give more time and thought to the root causes of the problems? It is never easy or comfortable to go back and acknowledge the presence of earlier flawed fundamental decisions, as these reflect on personnel, give rise to blame, and may damage career aspirations of senior personnel in organizations. Some of the potential unintended consequences and associated root causes are raised for consideration in the following sections.

Treating the Symptoms Rather than the Root Cause

We see this often in the health and medical arena. Of course, there is a great need for palliative action once there is a problem — one cannot argue with that, and most of the medical and pharmaceutical industry is committed to the process of palliative solutions. If a person already needs medical attention, it must be given. But this approach does not prevent a problem's occurrence or re-occurrence, so the process must include identifying those elements that can give rise to adverse medical conditions in the first place. It must also look for ways to either remove or minimize potential precursor causes — a case of both prevention and treatment. Does this apply to organizations in a general sense? Is the gut reaction to respond to a problem and put effort into treating/containing the symptom, rather than look for the fundamental reasons why the problem has arisen? *Is the culture too biased toward a rushed response for maximum early effect rather than a more measured, longer-term strategy?*

For an organization to operate successfully in the marketplace, urgent response in treating or repairing adverse symptoms is seen as a must to retain short-term business success and reputation. However, it is not necessarily the best strategy for longer-term viability and reputation maintenance — and possibly even survival. So, we must ask if organizations have gotten the balance right in this respect. Or, are they too configured to deal with the immediate to the detriment
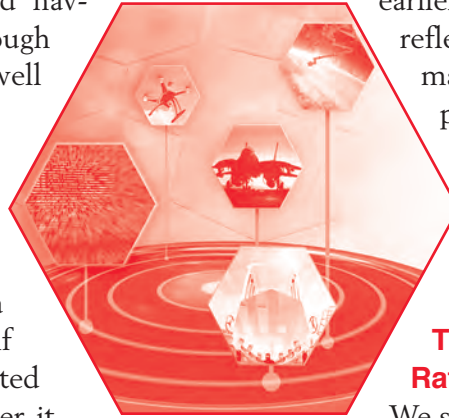
> For example, take the case of the U.K.'s Nimrod tragedy, where an in-flight fire in a Royal Air Force Hawker Siddeley Nimrod aircraft over Kandahar, Afghanistan in 2006 cost the lives of all 14 crew members. The fire and crash, subsequently reviewed by the Haddon-Cave enquiry, demonstrated that poor internal quality within what appeared to be a sound process structure was a root cause of the tragedy.

of long-term health? Shouldn't more capability and effort be directed toward identifying the *true* source of problems? Wouldn't it be of value to identify earlier, poor technical decisions that may have led to the organization's predicament? Does the organization have the process and commitment to look back and rectify poor technical decisions? Is there a case to suggest it is never "too late" to adopt a more strategic stance?

Cultural Change:
Technical Expertise to Process Driven

Many technical-based organizations have moved directly from management systems that emphasize technical leadership to systems based on more general financial and project management principles. There are good reasons for this, but there can also be downsides. For example, this change can result in a cultural shift from technical leaders managing with the aid of a relatively slim framework of company processes to a culture that is process rich and process demanding. Under the former structure, leaders and managers had the flexibility and authority to make realistic, balanced, appropriate and timely decisions, based on their direct technical experience and competence. In this structure, leaders and managers were not unduly trapped by what could become a stifling framework of company processes. Of course, there were drawbacks in this structure, too. Working arrangements were not necessarily consistent across the organization and there was a tendency to generate "silo" environments. But even silo environments didn't necessarily lead to significant drawbacks if those in leadership positions had their own effective processes for ensuring cohesion at higher levels of the organization.

There will always be an optimum balance between these two competing models that best serves the continued health of an organization. A model that employs a proliferation of processes to drive company programs, however, might see effective technical leadership subsumed by process and, as a result, become degraded. The unintended consequence may well be poorer technical decision making and harm to the organization's long-term health. One might wonder if the current drift toward this "process-rich" approach risks diluting true technical leadership and sound technical decision making — leading to the problems noted earlier.

We must ask: *Is excessive process compliance diluting the flexibility and quality of technical decision making? Are managers now being excessively managed by processes as a substitute for true technical competence?*

The "Process and Process"
Structure is Not Enough!

Is there a growing belief within organizations that following company processes will, in and of itself, lead to success? Of course, this is fallacious if insufficient care is taken with the quality of activity within of the process. In a highly technical organization, it is often true that it is easier for management to check whether processes have been followed, rather than delve into the technical detail and quality of the process elements themselves. As technology and programs become more complex, this will be an ongoing, and growing, problem — and a headache for management — in terms of how to comfortably deal with it and gain assurance that the quality within each process is sound. It is not hard to find examples of this belief that merely following process structure will bring success.

For example, take the case of the U.K.'s Nimrod tragedy, where an in-flight fire in a Royal Air Force Hawker Siddeley Nimrod aircraft over Kandahar, Afghanistan in 2006 cost the lives of all 14 crew members. The fire and crash, subsequently reviewed by the Haddon-Cave enquiry [Ref. 1], demonstrated that poor internal quality within what *appeared* to be a sound process structure was a root cause of the tragedy.

The overall management level may have seen a well-structured set of processes driving a modification program. There was a customer, an external technical supplier and an external independent assessor organization. As such, the process structure fit the bill. In fact, all three elements in the process failed to deliver the required quality. The customer was no longer fully competent in terms of comprehensively specifying what was required and ensuring that is what was delivered. The technical supplier (design authority) was lacking the quality of the "supplied product" and the independent adviser to the customer was lax in providing the appropriate level of independent scrutiny.

An even simpler example is given by the Minot failure in the U.S. which fortunately did not lead to a safety tragedy, but rather had severe political and career implications. In this case, the structure of multiple independent checks looked to all extent "fool proof" in preventing an error but nevertheless execution within the process elements was flawed and wrong items were delivered. That is the accidental flight carriage of nuclear armed rather than trainer cruise missiles from one base to another in the U.S."

Does overreliance on (and overconfidence in) a structured process present opportunities for unintended consequences? Does this overreliance on process create the danger of taking one's eye off the real quality requirements for each element? *The Nimrod Review* notes: *"The safety case regime had led to; compliance-only exercises; audits of process only…"* [Ref. 1]

Process, Routine and the Checklist Mentality

One of the dangers inherent in a process-rich environment is that activity can become too routine and "mechanical" in nature. Too much routine can dull the mind and encourage a mechanical approach, lessening in-depth thinking and analysis. For example, it generates a propensity to simply follow a specified process rather than to sit back and visualise whether the "whole" safety argument is compelling and complete. Of course, this is not an argument against the application of set procedures; in fact, procedures are intended to enforce a strong degree of rigor, which in itself is essential for the development of safe products and processes. But a too-limited adherence to routine can lead to overconfidence and potentially missing "hidden" aspects that might not be part of the process, but may well be of real safety significance. This problem can be exacerbated by time and resource pressures, where resources allocated to "thinking outside the box" may be viewed as an unnecessary luxury and not cost effective.

The use of checklists is also a laudable activity and is important for well-established and bounded processes. However, one should not only carry out the routine checking processes against the given list, but also keep in mind that the list might not be complete. Identifying omissions is just as important. In addition, it is important to understand what is meant by the "check requirement" against each element. It can be far more than just "has it been included" in the checking process. Rather, it should be a check on whether there is *full compliance* with the overall *intent* set for each element in the list. A mechanical approach to this activity can miss these two key features. As Haddon-Cave notes for the Nimrod tragedy: *"The Safety Case had become essentially a paperwork and 'tickbox' exercise"* [Ref. 1].

Technical Knowledge Management

If there is a trend to move from a technical leadership management style to one based more on process structure, then there is an associated need to ensure that the organization maintains and enhances the technical knowledge aspects of the business. This covers not only ensuring that the necessary technical knowledge and experience is gained and exercised, but also that it is not lost.

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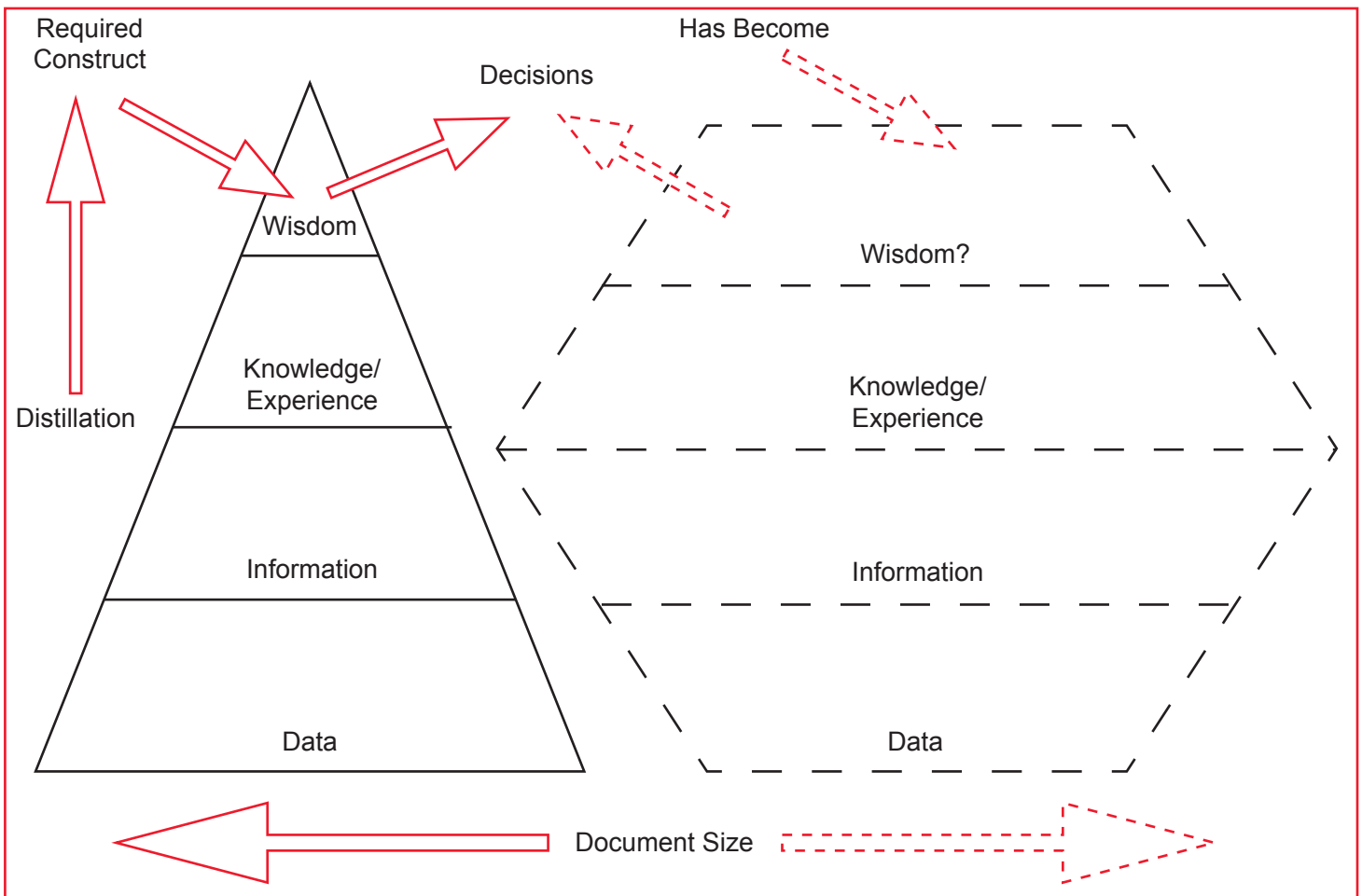
Figure 1 — Document Size Versus Position in the Knowledge Tree.

This is of greatest importance when, because of the nature of an organization's business, competence and experience are not easy to ensure. A company's technical knowledge and experience is often lost when senior people leave the organization. There is far less propensity for this type of loss in a management environment based on technical leadership, where this information/knowledge/experience is *actively* gained — and passed up and down — the management chain as part of normal business. When someone at the top of the chain leaves, the information, knowledge and experience is left behind and is still in "active" form. A management style with a strong technical leadership element will also have a strong technical mentoring bias. A more process-based management style, however, tends to require an additional proactive formal approach to knowledge management, to make sure it is effectively generated and captured before it is lost through retirement, resignations or for other reasons.

A strong technical leadership element to organizational management would help mitigate concerns about effective information, knowledge and experience loss, and would give extra assurance for retaining a strong technical edge.

Outsourcing

All organizations have to go through a process of outsourcing for "products and processes" to some extent. This arises when the necessary internal capability is absent, would take too long to develop and/or would be too expensive to undertake in a competitive business environment. Such activities follow a company's standard assessment process of whether to "make or buy." However, there are attendant dangers in outsourcing, which can lead to subsequent organizational damage.

For example, organizations need to retain their credentials as a capable customer. They need to be clear about what they want, able to clearly articulate this and able to ensure, through critical assessment, that what is received fully meets requirements. Alternatively, it could place this latter burden on an independent third party, but this approach, too, would not be free from further risk. In a case where safety is of paramount importance (and, of course, this concern is not restricted to safety), the customer needs to have an "expert customer" credential to clearly specify the requirement and fully scrutinize the received "product." A general

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test for this capability is that the customer not only knows what it wants but, in principle, has the knowledge and capability to produce the "product" itself if given the time, budget and facilities to do so.

Of course, losing the internal "expert-customer" credential will leave the organization prone to not getting what it wants. Suppliers are only too happy to give you what they want to give you, and any external advisers will be happy to give you the advice they want to give you. Both may fall short of what you really need. This was clearly exemplified in the Nimrod tragedy. The customer, then, really needs to stay ahead of the game. *The "false comfort" of knowing that one can source the "product" externally can lead to a failure in retaining internal "expert customer" capability.*

Being too reliant on external sources also has the attendant danger that the source may well decide to get out of the game — and suddenly. The organization's overall strategy should keep this in mind. The danger can be significant in the case of a unique requirement and a single supplier.

Hands-On Experience

Knowledge, capability and experience can be accrued through "hands on" activity or through reading and being trained. Are they the same thing? Is there a dangerous precedent when we begin to put too much faith in the latter at the expense of the former? Does this have an impact on developing quality technical leadership? Can sound technical leadership be based on training, as opposed to direct experience? One may question why many scientists, engineers and technologists now spend a significant part of their early careers undertaking document review or taking concepts only to the "PowerPoint" stage, as opposed to working through to more "implementation" phases of a program. A further example of this issue appears when authors of technology specification and process documents have limited

or no real hands-on experience in the technologies they are documenting.

The Burden of Paperwork

This problem arises in a number of categories all of which can have significant impact on ensuring safety.

- All organizations produce an ever-increasing volume of documentation. An effective strategy is needed to ensure proper linkage in documentation, where appropriate. Here we are talking about a comprehensive document, information, linkage and control management system. Modern information technology (IT), in principle, provides the tools for this. However, in many cases, burgeoning information continually challenges the ability to effectively accomplish this. Also, different parts of an organization also often use different protocols and proprietary IT tools. In principle, this does not matter if these information systems are truly independent or if there is a comprehensive mapping tool available. Organizations are continually challenged to ensure that they have a sufficiently integrated documentation/information system in place — one that has all the necessary inter-connectivity and change control (it is not uncommon for documents in an active program to change quite frequently). Are we all working on the latest authorized version of the document — and, if not, what is the impact on safety?

- An attendant problem may arise due to a conflict between technology and documentation needs. For example, an improvement in safety may require a major activity in terms of modifying, updating, and/or re-configuring documents. Therefore, there may well be opposition to a safety enhancement because of the extra documentation burden. This might even be used as part of the "As Low As *Reasonably* Practical" (ALARP) argument for not going forward with the change!
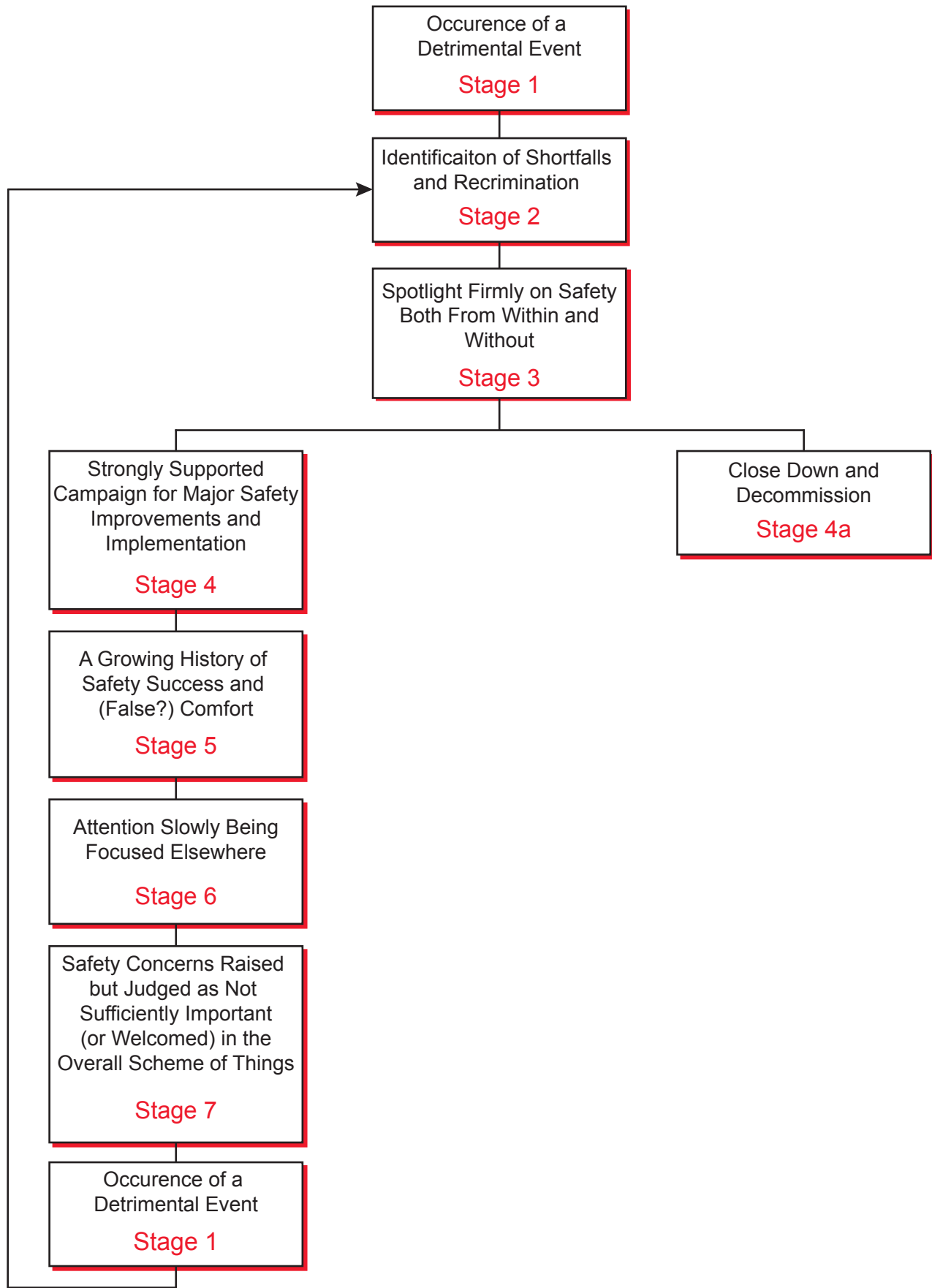
Figure 2 —The Normal Accident Cycle.

- Because many organizations have yet to fully enter the digital age, documents still exist in other formats, such as hard copies, microfiche, photographs, optical and sound tapes, etc. Maintaining the appropriate inter-connectivity in these cases is much more difficult — and inefficient — in the absence of a fully integrated digital system. Although all organizations are, or should be, engaged in transferring these alternate formats into digital form, the process is resource and time intensive, especially if it involves significant legacy material that still has a significant role in ensuring safety.

- Data, information and its associated documentation should ideally form a pyramidal structure in terms of size of content and its level of importance within of organizational decision making, as depicted in Figure 1. This figure illustrates the steps in converting base data into a "finished and succinct form," which enables wisdom and sound judgment to be exercised throughout the organization. Recently, however, there appears to be a tendency to distort this structure — the content does not appropriately reduce in size as one progresses up the structure, and this gives rise to problems related to "not seeing the forest for the trees" (that is, clarity with regard to key safety aspects) in effectively progressing along the steps in the pyramid. This adds to the difficulty in enabling sound and safe decision making at various levels in the organization.

- The subject of documentation also begins to enter into the "Big Data" arena when considering what relevant data need to be collected — and from where — as well as what algorithms are best suited to condense it into appropriate "customer needs" without losing key safety messages as one progresses through the symbolic pyramid in Figure 1.

One may well ask: *"Does the burgeoning of not properly targeted documentation have the unintended consequence of making safety decisions more difficult and, perhaps, more prone to errors?"*

As noted in *The Nimrod Review*: "The exponential growth of the 'the Safety Case industry' has led to a culture of 'paper safety' at the expense of real safety. It is easy to produce vast quantities of paper; it is more difficult to focus on the key hazards and think about them."

and

"The safety case regime had led to a culture of 'paper safety' at the expense of real safety and did not represent value for money. Its shortcomings included bureaucratic length; obscure language, failure to see the wood for the trees." [Ref. 1]

Organizational Fear of Safety, Realism and Over-Conservatism

Ironically, company fear of "over safety" can result in an overzealous approach, which can actually lead to a less-safe situation. This is often associated with a major concentration on relatively minor aspects of safety and, in doing so, diverting thought, effort and focus from those areas where failure will be of more significant consequence. Although the general principle of "Target Zero" is sound in its *aspiration*, overzealous subservience to it can lead to a loss of focus on safety priorities. It can drive an organization into a more pedantic, rather than a more visionary, mindset and into the realm of "diminishing returns." This leads to a growing list of requirements and organizational burdens that can eventually overwhelm the organization's ability to meet the requirements of "real" safety and lead to organizational paralysis.

It is all too easy to place every issue, even those that have a limited impact on safety, on the list for action. In a culture like this, employees often feel fully covered, cast-iron protected and not culpable. It takes more thought, knowledge, experience and *courage* to take an alternative approach — that is, to make realistic and proportionate decisions *at an early stage* on what is significant, what needs action, what is not significant, and what should be considered only if time and overall resources allow.

Another downside is that organizations may generate a culture of being obsessively safe and, as such, shy away from advancements that are both safe and beneficial to the organization. A more balanced approach would be to nuture a culture based on doing things of value safely. Of course, often associated with this organizational fear is an initial — and, on the face of it, laudable — approach of setting safety standards too high. In reality, standards that are very conservative, compared with regulatory requirements, may become overburdening and beyond realistic reach. The danger is that, having set such standards, the organization may well be regulated against them and any attempt to move to a less-conservative and more-realistic position might be seen in a negative light.

The unintended consequence in this case is the danger of directing too much effort toward the trivial at the expense of the more important and, as a result, losing the hearts and minds of the workforce.

Another danger arises when an organization sets its sights on a "Worst on Worst" (WOW) safety assessment strategy and persists in this approach when proportionality indicates that a more realistic and manageable assessment is more appropriate.

Effective Communication and Interfaces

It has long been recognized that interfaces have the potential for creating significant problems in integrated programs. This applies equally to safety as it does to any other program factor. Many organizations have moved to a matrix form of organizational structure, and this approach has led naturally to an increasing number of "elements" and associated interfaces in both general management and large technical programs.

As programs become more complex, we often see a further proliferation in the number of interfaces. This proliferation is exacerbated by an associated propensity for breaking programs down into "neat," smaller elements. For proper cohesion in any program, there must be effective management oversight, communication and understanding across all interacting interfaces. Managing an ever-increasing number of interfaces can create a growing challenge to the overall cohesion of major programs — in short, items start to fall through the cracks.

We must ask: *Are we managing this issue appropriately? Does this proliferation of interfaces give rise to unintended weaknesses and detrimental consequences?*

The Role of Corporate Memory?

Do we truly understand what is meant by effective "corporate memory," as well as its impact on safety? Organizations implement programs, make mistakes, correct them and learn to become more successful. These organizations exercise the well-known process of "Review, Learn and Improve" (RLI). Therefore, we might expect that the information gleaned from this process will be stored in corporate memory and be called upon for application when required in the future.

There are two distinct elements to corporate memory:

- **Active Memory:** This is information that was learned the hard way and now resides — promi-

> 66 When active memories are lost (through retirement or employees moving on), what corporate memories really remain? Is it simply passive elements that may or may not effectively 'rise to the fore' in a relevant future context? 99

nently — in the heads of those who directly experienced previous failure.

- **Passive Memory:** This is information that was documented for posterity — maybe not always completely or in the proper context — and which hopefully will be remembered as relevant, be easily located, and be extracted in an efficient and effective manner when required at a later date.

When active memories are lost (through retirement or employees moving on), what corporate memories *really* remain? Is it simply passive elements that may or may not effectively "rise to the fore" in a relevant future context? In fact, effective corporate memory (in the context of future application) may really reside only in the form of active memory, among a limited number of people who experienced the previous pain and grief of getting it wrong. If so, effective corporate memory may well be something of a "transient beast" that resides or disappears with the presence or absence of key personnel.

For example, consider the cases of the 1986 Challenger and the 2003 Columbia space shuttle tragedies. Was there a loss of active corporate memory due to key staff loss prior to Columbia? This second tragedy may be an example of the so-called "normal accident cycle" [Ref. 2], represented in Figure 2. The loss of active corporate memory and a feeling of not wanting to fail again — set against the rising challenge of other business forces — would be contributing precursors to failure, as exemplified in Phases 5 to 7 of the cycle.

We must ask: *Does over-reliance on passive memory have unintended safety consequences?*

More for Less and Organization Stability

We are now confronted with budget and resource constraints; in fact, many of us and are familiar with the mantra of "do more with less." This is a great aspiration and, at face value, a laudable aim. However, simply doing more has no real advantage if that "more" has limited value. The *real* goal should be achieving *more value* with less. The dilemma centers on discriminating between *"more"* and *"more value"* — and having a clear understanding of what "value" really means. Ironically, we often seem to be in danger of achieving *less*

value with *more effort* and resources. In safety, a clear understanding of these differences is key to success. Problems arise when there is an over-concentration on small issues — more, but of limited value — with the consequential loss of resources available to be applied to more valuable issues of consequence.

This problem is often associated with the stability of an organization. For example, endless re-organization can become the "more effort" not necessarily leading to the goal of more accrued value in safety. Some "real-world" examples of this are included within the Haddon-Cave report on the Nimrod tragedy. [Ref 1.]

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- "There is a large element of continuously trying to get 'a quart out of a pint pot,' with all the attendant hazards that such a scenario presents to safe aircraft operations."
- "The few, the tired."
- "Very often the requirement to do more comes from a situation of lack of stability where a significant effort has to be directed towards re-alignment to the changes in organization as opposed to the core activity.
- "'We trained hard, but it seemed that every time we were beginning to form up into teams, we would be reorganized. I was to learn later in life that we tend to meet any new situation by reorganizing; and a wonderful method it can be for creating the illusion of progress while producing confusion, inefficiency, and demoralization.'" — Gaius Petronius Arbiter, 210 B.C."

After two millennia, are we still failing to learn this lesson?

Summary

This paper has commented on trends that have occurred in organizations which, on the face of it, have been put in place for positive reasons. However, such "improvements" are not necessarily free from negative safety consequences. As such, a number of such trends have been discussed in the general context of their potential for creating unintended consequences, and what these consequences, might mean to safety. Of course, there is always a balance in that many changes are made for good reasons. Still, there is always the danger that the thinking involved may have been too tightly focused on the "highlighted advantage" and not on the wider aspects. This is certainly not an argument for avoiding the introduction of targeted changes that are intended to enhance safety; rather, the call is to be aware of the possibilities of unintentional negative consequences.

About the Author

Malcolm Jones has led the Distinguished Scientists group at the Atomic Weapons Establishment (AWE), currently holds the position of Scientific Adviser to AWE's Chief Scientist and directly supports AWE's Chief of Product Assurance. His career at AWE has taken him through a wide range of scientific and engineering topics, but he has maintained a continuous association with nuclear weapon design and process safety, as well as top-level nuclear safety standards. His interests extend to corporate safety cultures and the root-cause reasons for failures. He is a Fellow of the International System Safety Society and is an adviser to a number of senior U.K. Ministry of Defence and AWE safety bodies. He has been awarded an MBE in the Queen's Birthday Honours List for contributions to the U.K. defence industry and is a recipient of the John Challens Medal, which is AWE's highest award for lifetime contributions to science, engineering and technology. He has also been honored by the All-Russia Research Institute of Automatics (VNIIA) in the Russian Federation (R.F.) for his work in fostering nuclear weapon safety collaboration between the U.K. and the R.F. ◉

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