Novel approaches for Improving Operational Performance, Resilience and Safety for Emergency Services Personnel

A study into research and training methodologies for improved operational resilience, safety and decision-making using emerging innovative risk and human factors based approaches in the areas of high reliability organising, mindfulness and emotional awareness

Study report

Engine 64 crew Modoc, northern California

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April 2014

A report on a research and training study supported by funding from the Emergency Services Foundation Scholarship conducted by Dr Carl A. Gibson, 2nd Lieutenant Benloch Fire Brigade, Kyneton Group, District 2, Country Fire Authority and Director Risk Management, La Trobe University.

Acknowledgements

I am extremely grateful to the Emergency Services Foundation (ESF) for their financial support and to many of their alumni for their encouragement and support whilst planning for, and undertaking the study tour. My thanks also go to the senior officers within the CFA that supported my application to the ESF and to those senior officers in other agencies that believed in the wider applications of this work.

Without this support the study would not have been possible.

I am especially grateful to Inspector Matthew Anderson of Victoria Police who has been a constant source of guidance before the study's commencement and after its completion, and to Jenny Davis of the ESF for her magnificent assistance throughout the whole process.

Finally I would like to express my thanks to everyone in the USA, named in this report, who gave up so freely of their time and wisdom. They were all wonderfully welcoming, challenged my thinking, introduced me to many new ideas, enhanced my understanding, and subtly (and in some cases not so subtly) gave my research a change in direction. My time in the USA has created a group of great friends and collaborators that will continue in a number of research and development relationships.

This study tour has generated a whole range of new knowledge, which I hope will, in the fullness of time, result in real improvements to operational performance and safety.

Executive Summary

Background to the Study

The broad aim of the study was to undertake an examination into emerging research, techniques and practices being developed for US first responders and military personnel in the areas of risk, resilience and the application of neuroscience. The study was structured to enable a review of novel research being undertaken (in US universities), the translation of research into training and development programs, and the deployment of this training into operational competencies on the frontline. This work was based around four key interrelated themes:

- The training of personnel in the principles and practices of ***high reliability organising*** (HRO) with the objectives of enhancing operational safety and performance. This involved an examination of changing directions in the content and delivery of HRO training being developed by the Wildfire Lessons Learned Center in Tucson Arizona , and its practical field application with the firefighter crews from the National Forests and National Parks Services in northern California.
- The development of new approaches for ***learning lessons*** from accidents and other incidents, being undertaken by National Forests Services (NFS) personnel from Tucson (Arizona), Missoula (Montana) and Boise (Idaho). The application of new thinking from HRO and sensemaking included discussion with one of the founders of the HRO discipline at the University of California, Berkeley. This included an examination of the changing emphasis of the response to serious accidents, moving away from fault finding investigation to a lessons learned approach. which included discussions with federal personnel deployed to assist with the response to the Yarnell Hill disaster on 30 June 2013 (where 19 members of a hotshot crew died in a burnover), and the use of a new Learning Review process for investigating the recent death of a Modoc smokejumper incident controller as a result of a branch fall on 10 June 2013.
- With the NFS Rocky Mountain Institute at Fort Collins Colorado and the University of Miami, an examination was undertaken of new thinking on the application of ***mindfulness*** techniques in front line operations. The impact of stress on sensemaking (including situational awareness) was looked at along with its effect on impaired decision making and the role of emotion on cognitive function. This included a range of techniques for recognising and managing emotional state and stress on the front line.
- In collaboration with a NFS human factors and risk specialist, a new research project was initiated developing novel approaches to the assessment of risk and decision making in dynamic environments. This concept, ***Margin of Manoeuver (MoM),*** combines a multidisciplinary range of concepts from HRO, mindfulness, cognitive functioning, neuroscience, psychology of leadership and resilience engineering.

Key Findings from the Study

1. High Reliability Organising

High reliability organising (HRO) is concerned with establishing new competencies, thinking and behaviours that allow unexpected change and challenges to be more effectively managed. In recent years, within federal firefighting services, the emphasis has changed from a concept of high reliability *organisations* to high reliability *organising* with a far greater emphasis on the individual and the crew, rather than on the organisation as a whole. HRO practice is based upon developing capabilities which allow for:

- Better anticipation and understanding of unexpected change, including:
  - Paying more attention to *errors* early on when their impact is small;
  - Watching for processes, systems and information that have been *oversimplified*, and that may in fact hide problematic complexity;
  - Increasing *sensitivity to operations*, increasing focus on and understanding of what people are actually doing on the front line;
- Improved ability to contain adverse impacts and cope with change, including:
  - Recognising that the location of relevant *expertise* shifts within organisations, and more specifically within teams, as the demands of the environment change, and that these shifts in expertise need to be encouraged and supported;
  - Commitment to *resilience*, so that organisations and teams recognise the need to adapt to dynamic change that may be occurring and that they have access to strategies and resources with which to undertake such adaptation

Training in HRO has been provided over previous years in the form of multiday formal training, with a heavy reliance being based upon the research and conceptual work of two of the principal academics in the field: Karl Wieck and Kathleen Sutcliffe. This work has created a cadre of HRO subject matter experts across the USA (from those attending the course), and a range of local examples of the effective application of the HRO principles. However, there is still a substantial gap in performance between the NFS and that of the recognised high reliability organisations.

There has been a fairly recent recognition that HRO training needs to have more direct relevance to operational needs, being more experientially based and that HRO on its own will not drive the required behavioural and cultural changes.

However, HRO can provide a strong foundation on which to build a more integrated approach to safety and performance improvement, for example incorporating mindfulness-based mind fitness training, comprehensive physical, emotional and cognitive development frameworks, and an understanding of the operation of the human brain in complex environments (as explored in the development of MoM.

2. Improved learning capabilities

The US Government has invested substantial resources into establishing the capability to capture and make sense of lessons learned from incidents and accidents. This has seen the start of a cultural change, for example, in the move from a traditional blame culture towards a more 'just culture'. The application of techniques such as the 'after action review' (AAR), 'facilitated learning analysis' (FLA) and Learning Review are important signposts on this cultural transition.

Acceptance of this transition is not yet universal, with some resistance at different levels of the hierarchy. For example, a major challenge has been getting local crews to effectively use the AAR, whilst more general adoption of the FLA still has some way to go. However, where these approaches are well managed and their outputs captured and disseminated, the learning opportunities appear to be greatly welcomed by front-line personnel.

A next generation approach to learning from incidents and accidents is beginning to emerge: the 'Learning Review' which has been perfected based upon experiences such as the review of the Saddleback fire fatality in 2013. A particular aspect of this approach has been the separation of the data collection phase form the analysis and sensemaking phase. This ensures that analytical techniques are chosen to fit the data available, rather than analysis biasing data collection. This new approach also draws together competencies and thinking from a variety of disciplines, rather than just an accident investigation paradigm.

Personal experience within the CFA suggests a similar problem with the conduct of the AARs, particular following a lengthy deployment. As a result of this an "On Action Review" process has been looked at to allow errors and lessons learned to be reviewed whilst on deployment. This approach and was used in a small number of fires in a local CFA brigade. To support this local initiative a series of aide memoire pocket cards have been developed.

3. The application of Neuroscience and Cognitive Psychology to Improved Operations

Over the last few years there have been incredible advances in our understanding of how the brain works and the functioning of the mind. This research has started to be implemented into operational contexts with great success.

One area receiving increasing attention has been training in and the practice of mindfulness. Mindfulness has a history over several decades as a core tool for addressing a range of psychological issues, from mental health and stress management to enhancing learning performance and operational capabilities. In recent years this has been extended to its use in emergency response and military combat operations.

The Study reviewed recent progress made on defining changes in brain function and structure following mindfulness training. This work had been applied to US Marines prior to operational deployments in Iraq and Afghanistan, delivered as the Mindfulness-based Mind Fitness Training (MMFT) program. This form of training was shown to enhance learning and recall of participants in a range of operational training tasks, reduced stress levels during deployment, improved overall

operational performance, lower stress levels post deployment and faster recovery from traumatic incidents.

The Study also looked a highly successful mindfulness program that had been delivered over a number of years to law students, practising lawyers and judges. Again the program showed improved cognitive capabilities, lowered stress, enhanced performance and overall improvement in healthy lifestyle.

The application of these new frameworks with local NFS and Parks Services crews was observed at the Lava Beds National Monument, which also included training in other related programs such as the US Army's Comprehensive Soldier Fitness Program and the Corporate Athlete Program.

Other areas of cognitive psychology are being introduced into training and the development of new methodological frameworks. This has included consideration of the cognitive functioning of automatic /intuitive thinking and its relationship with the more effortful and slower analytical/reflective cognitive system. Inclusion of these concepts into a range of training has been shown to improve participants understanding of how they react or respond in certain situations and has helped them to develop strategies to better manage the situation.

Similarly, research on the functioning of the brain into distinct modes of leadership thinking introduced exciting possibilities for improving crew and IMT leadership in volatile situations.

The application of this wide range of research findings is already being made in improving situational awareness and sensemaking of crew on the ground. There are tangible benefits to overall safety and performance that can be achieved from applying these techniques. Even a minimal commitment to introducing learning on how the mind works and how experiences and emotions combine to create harmful stress and impaired decision making can be a powerful mechanism to improve workforce performance.

4. A new way of considering risk

The Study enabled a new research program to be established with the NFS looking at the limitations of current approaches to risk management, and the development of a new framework to help compensate for these limitations.

Current approaches to assessment of risk are ultimately derived from well-established actuarial models, which work extremely well in the contexts they were developed for: relatively simple linear systems. As the context becomes increasingly complex, such risk techniques work correspondingly less well. In highly dynamic environments of high uncertainty, these techniques have very limited utility.

In answer to this problem, a new concept has been developed: "Margin of Manoeuvre" (MoM) which provides a conceptual framework to bring together the various ways in which we understand change in our environment; change in our own physical, physiological and mental capacities; change

in the capacities of others that we depend upon; and changes in the availability and capabilities of other resources and systems that we may need to access.

MoM provides an intuitive way of rapidly modelling these changes in the field, to quickly determine if a person's or team's MoM is increasing (hence levels of safety and performance should be increasing) or is decreasing (therefore safety and performance levels decreasing towards unacceptable levels).

MoM integrates a range of concepts from HRO, resilience engineering and risk management. It is supported by incorporating an understanding of the cognitive and neurosciences to enable individuals to better understand how their minds work under stressful situations, how their perceptions of events may be biased and how their decisions can be affected by these perceptions, emotions and the interaction with other people.

MoM integrates our current strategic operational and tactical practices, and provides a 'glue' of cognitive competencies and strategies that assist in keeping the whole working together.

The MoM concept has been used successfully in pilot training in the US wildland firefighter community and has been applied in conducting the Saddleback fatality learning review. Within Victoria, the concept has been 'socialised' with a variety of emergency services personnel with highly supportive feedback. It has been used as part of pre-season preparedness in a local CFA brigade and used to enhance operational capabilities on a number of fires during the current season.

The MoM concept has been presented to a range of Victorian Government Departments responsible for oversight of critical infrastructure sectors (energy, water, transport, health, and food) and has been strongly embraced. This has resulted in MoM being integrated into a new risk and criticality self-assessment application developed on behalf of Department of Premier and Cabinet for the Victorian State's critical infrastructure sector as part of the new all hazards preparedness arrangements.

Recommendations

i) It is recommended that the Learning Review process, recently developed by the US NFS (Ivan Pupulidy) is assessed for its feasibility for introduction into CFA and other emergency services organisations for the creation of lessons learned from serious accidents and other incidents.

ii) It is recommended that instruction be provided on cognitive, behavioural and emotional psychology to encompass emerging learning from these fields with the aim of improving frontline safety and operational performance, reducing the impacts of harmful stress and enhancing incident management capabilities and overall leadership decision making. It is further recommended that such instruction be incorporated into and used to enhance existing training and development schema.

iii) It is recommended that training be developed in the Margin of Manoeuver framework, to incorporate findings from cognitive and behavioural psychology, HRO, resilience engineering and new safety accident models. That such training can be both incorporated into existing training and development schema, can be readily incorporated into pre-season training briefings, and can be supported by online and other e-media resources. The potential also exists to develop Margin of Manoeuver into a tool for the conduct of independent and/or self-assessments of ongoing strategic, operational and tactical capability.

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Study Aims

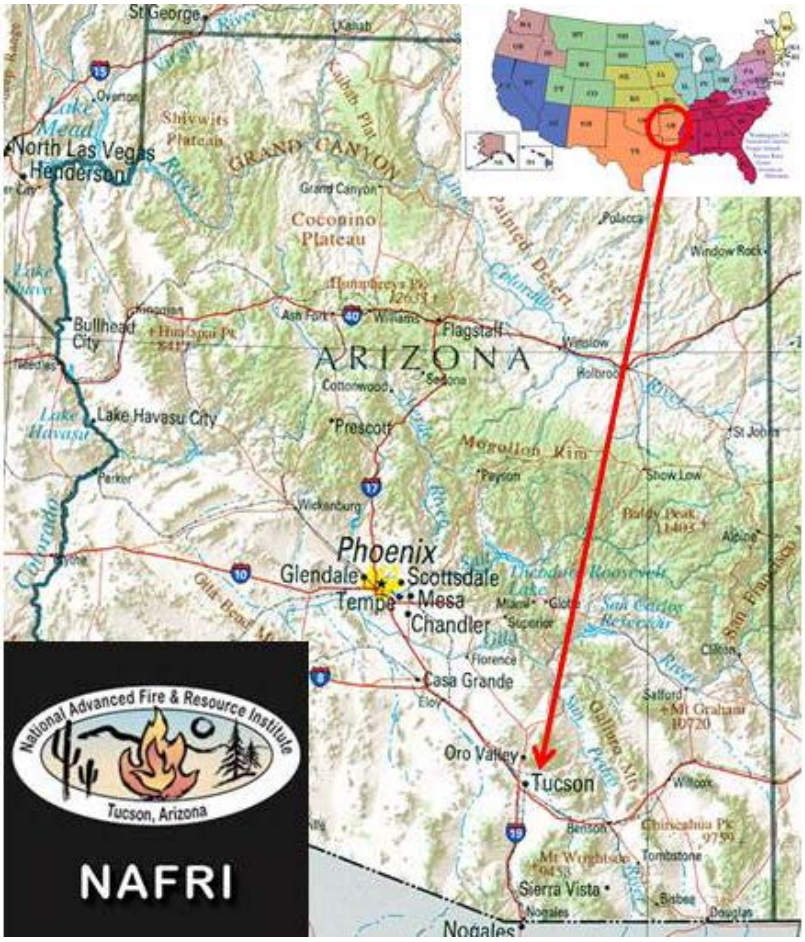
The aim of the study tour was to identify opportunities for improving operational performance, particularly with respect to safety from innovations in human-factors related initiatives developed for US federal fire-fighters and the US military. This specifically involves engaging with new research, training and development in the interrelated areas of situational awareness, high reliability organising, mindfulness and emotional intelligence.

The study tour consisted of:

- A review of training and development in High Reliability Organising (HRO) being conducted for US federal firefighters, particularly that being undertaken by Dave Christenson at the Wildfire Lessons Learned Centre at Tucson Arizona;
- The application of mindfulness techniques for wildland firefighters, both as a contribution to enhancing the application of HRO and as a contained approach for improving situational awareness, improving control of emotions in stressful situations and for improving the overall management of and recovery from stress. This work was being pioneered by Jim Saveland at the Rocky Mountain Research Centre, Colorado;
- The work in Arizona and Colorado also allowed an insight into the application of these human factors elements into the Federal support response and investigation into the Yarnell Hill fatalities;
- An exploration of emerging research being conducted by Professor Amishi Jah at the University of Miami which was beginning to uncover the neuroscience behind mindfulness and emotions. In particular, this part of the study was to examine the application and effectiveness of mindfulness within US military programs, with a view to looking at the feasibility of their adaptation to an Australian emergency services adoption. The visit to the Jah Lab at this time was also able to facilitate the start of a collaboration between the University of Miami and Miami Fire and Rescue;
- An examination of the extension of mindfulness to practical skills development for legal professionals being undertaken by Professor Scott Rogers at Miami Law (University of Miami);
- An opportunity to see the delivery of HRO and mindfulness training and its application on fire prevention and response by federal firefighters in northern California (in the Modoc) being led by Captain Ben Iverson;
- An examination of the latest thinking in the ongoing development of HRO concepts being undertaken by one of the founders of HRO, Professor Karlene Roberts at the University of Berkeley;
- Whilst at Berkley, the opportunity to work with Ivan Pupulidy (US Forest Service, Boise) on the application of these principles as a framework for conducting an investigation into a recent fatality of a smokejumper in the Modoc;
- The establishment of a research collaboration with Dr Anne Black (US Forest Service Missoula, Montana) to examine the competencies and perceptions in communication practices that affect sensemaking in wildland firefighting;

- The initiation of a research collaboration with Ivan Pupulidy (Human Performance Specialist, National Forest Service) that has extended beyond the term of the scholarship and has seen the ongoing development of a new concept “Margin of Manoeuver”.
- Most recently the incorporation of Margin of Manoeuver into the Victorian State Government’s new arrangements for critical infrastructure all hazards preparedness.

Chapter One: Training and Development in High Reliability Organising



Wildfire Lessons Learned Centre, National Advanced Fire & Resource Institute, Tucson Arizona

Advances in High Reliability Organising

The visit to the Lessons Learned Centre was hosted by David Christensen (Deputy Director), one of the leaders in the development of high reliability organising (HRO) training for federal firefighting services.

The purpose of the visit was to:

- Review current concepts in HRO, in particular to look at methodologies that contributed to improved adoption of the HRO principles. This included, for example, new developments for improving error detection and incorporating these into lessons learned;
- Examine course training methodologies for teaching HRO to incident management teams and front-line firefighters; and
- Identify existing barriers to the adoption of HRO principles.

Identifying Key and Emerging Issues in HRO

The visit commenced with a combined meeting with experts (both in person and via teleconference) to discuss key issues of concern and other emerging issues of relevance to the ongoing development of HRO.

The discussions centred on the relationships between human factors and high reliability. In particular the roles of leadership and group culture and the linkages to organisational learning.

Meeting participants

David Christensen LLC, Arizona
Dr Anne Black, Aldo Leopold Wilderness Research Institute, Missoula, Montana
Travis Dotson, operations analyst, LLC, Arizona
Brenna McDowell, weather forecaster,
Ryan D. Myers, Operations Specialist, Fire Ecology & Training – NAFRI
Doug Howorth, Program Mgr, Wildland Firefighter Apprenticeship Academy, McClellan, California

A Neuroscience Basis for Leadership

The key role of leadership in gaining the benefits from HRO is supported by the findings from neuroscience and social intelligence. The participants discussed the influences that leaders' behaviours and moods had on the rest of their teams. For example, the phenomenon of 'mood contagion' (Goleman and Boyatzis, 2008), whereby positive or negative behaviours can trigger associated behaviours in others. At an empirical level this has been understood for some time in psychology, for example its use in Betari's Box (see Figure 1.1).

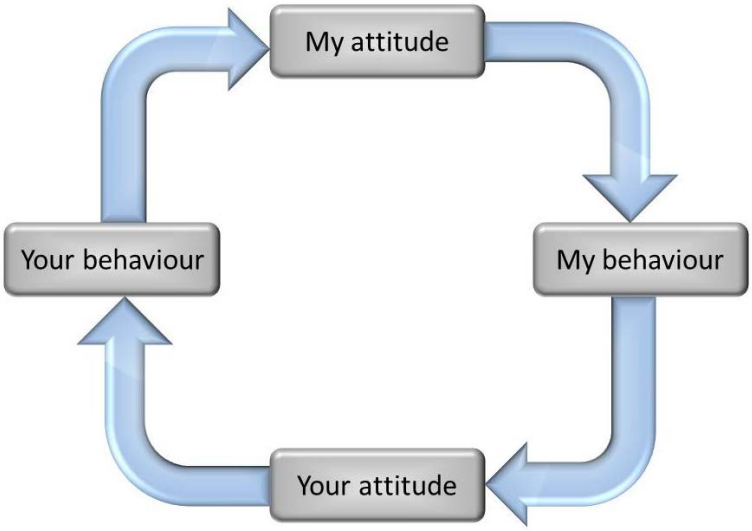


Figure 1.1: Betari's Box

However, over recent years this has been supported by findings from neuroscience that shows a chemical connection is established between individuals' brains. The term 'social intelligence' has been used to describe interpersonal competencies that 'inspire' others through affecting specific brain regions and stimulating the production of certain hormones. Recent brain imaging has implicated highly specialised neurones in the brain in such a role, the so called mirror neurones

(Boyatzis, 2012). These mirror neurones have also been implicated in the transfer of a state of stress from one individual to another.

An 'Emotional and Social Competency Inventory' measurement tool has been developed to assess behaviours contributing to social intelligence (Goleman and Boyatzis, 2008) and is based upon:

- ***Empathy:***
  - Understanding what motivates others and sensitivity to their needs;

- ***Attunement:***
  - Awareness of the moods and feelings of others;

- ***Organizational Awareness:***
  - Understanding of culture and values of teams and/or the organisation,
  - Understanding of the norms of social networks;

- ***Influence:***
  - Ability to persuade others and gain their support;

- ***Developing Others:***
  - compassion and provision of effective mentoring;

- ***Inspiration:***
  - Ability to articulate a compelling vision,
  - Ability to create a positive emotional state,
  - Success in helping other achieve their best performance;

- ***Teamwork:***
  - Encouraging everyone to contribute,
  - Supporting and encouraging cooperation.

Earlier psychology research suggested that there were broadly two leadership styles: 'task leader' and 'socio-emotional leader' (Bales, 1958), this separation of leadership behaviours being supported by many subsequent studies. Recent findings from neuroscience have identified two discrete neural networks in the brain that are antagonistic towards each other (recently reviewed in Boyatzis, Rochard and Jack, 2014). These regions are:

- ***Task positive network***: activated by non-social tasks (such as logical reasoning, language, causal and mathematical reasoning) and plays a key role in attention, routine problem solving; decision making and controlling action. It is associated with leadership roles such as financial planning, problem solving, forecasting, etc.

- **Default mode *network*:** associated with ethical decision making, social cognition, emotional self-awareness, intuitive problem solving and creativity. It is associated with leadership roles requiring an understanding on one's own and other's emotions, creating a shared sense of purpose, etc.

Increasing activation of the task positive network depresses activity in the default mode network. Hence, increasing analytic behaviour discourages empathic behaviour (Figure 1.2). When not engaged in either type of task the brain naturally cycles between the two networks several times each minute. However, the brain cannot operate simultaneously in both modes, and it is possible for an individual to become 'stuck' in one of these modes. For example, responding to an external threat causes increased attention on what is happening, elicits a task response - activating the task positive network, which in turn suppresses the default mode network which in turn supresses empathy and other 'people-oriented concerns'. This means, for example, that when in crisis mode we can become more focussed on the task itself and substantially less focussed on the people.

Similarly, where an individual leader is overly attuned to relationships, the default mode network becomes highly activated, with a corresponding depression of the task positive network. This results in a decreased focus on the task, which in turn can lead to an increase in errors and reduced performance.

Effective leadership, therefore, requires an ability to switch between these networks and behaviours as required. Good leadership demonstrates a continuing switching between the two networks and sets of behaviours as most activities are engaged in. However, individuals may have one preferred mode over the other and allowing individuals to operate long term in one particular role requiring a dominance of one network over the other for long periods of time may not be sustainable. There is evidence that prolonged dominance of one type of network over the other may contribute to mental ill health and can precipitate burnout.

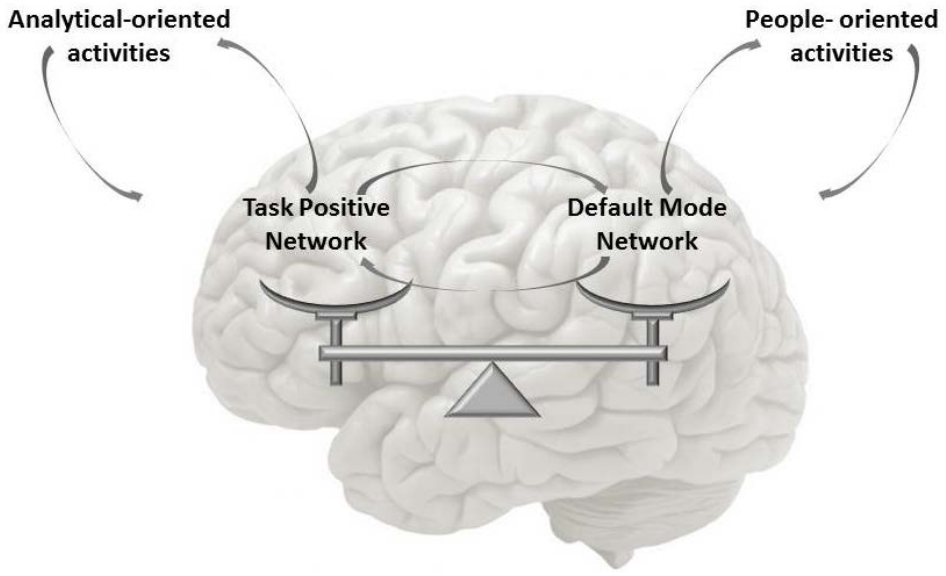


Figure 1.2: neural basis of leadership modes

There are two broad strategies which can assist in dealing with this:

- Training of individuals to develop competencies in both task oriented and relationship oriented competencies, so that switching between modes requires less cognitive effort; and
- Training individuals to recognise contexts and cues (internal to self, and external – from other people) to prompt switching between the two networks.

Mindfulness and Compassion in Leadership

There was considerable discussion regarding the recent development and adoption of the 'SHARP' concept (see inset box below). This has emerged from the recently completed PhD studies of sports and exercise scientist (and former firefighter) Dr Alexis Lewis (Lewis, 2013) who has been examining the role of mindfulness and compassion in leadership and decision making in firefighting operations. In the context of this research mindfulness was regarded as:

"paying attention, on purpose, to unfolding life events" (Kabat-Zinn, 2003).

Whilst "self-compassion" was regarded as comprising the mechanisms used to tackle difficult emotions and the feelings that they invoke. Self-compassion is associated with:

- '**Kindness**': along a spectrum from 'self-judgement' to 'understanding and care' for oneself;
- '***Common humanity***': regarding how individuals regard the experience of occurrences along a spectrum from 'isolated incident' to 'experiences as part of a larger human experience'; and
- '***Balance***': along a spectrum from 'over identifying with thoughts and emotions' to 'balanced perspective' of the current experience.

SHARP

Stop: taking a brief moment out to remember to pay attention to what is happening

Here: purposely recognising where one's awareness if focused

Act: recognising what one is actually doing

Respond: what is the person's response to stimuli (what sensations, emotions, or inner dialogue they are experiencing)

Person: is the person 'taking care' of themselves. For example, if they are allowing themselves to practice mindfulness, if they have positive feelings towards themselves, the degree to which they may be blaming themselves.

Both mindfulness and self-compassion are believed to have major effects on decision making.

The purpose of the 'SHARP' mnemonic is to get individuals more focussed on, and aware of their own attention and how they are being affected by their experience as it is occurring.

Participants in 'SHARP' training were provided with rubber wristbands as aide memoires to the mnemonic.

Participants reported that using SHARP in operational settings provided them with a mechanism to keep calm, regain their focus, better control their emotions, and keep a check on what was happening during operations. The technique proved particularly useful in helping to improve interpersonal relationships and better manage conflict.

The challenge is to get SHARP routinely used by firefighters so that it becomes habituated in common daily practice. Habits take an average of 66 days to become established (but can range between 18-264 days depending upon the subject matter) (Lally et al, 2010).

Apprenticeship Academy

The Apprenticeship Academy has introduced concepts of high reliability organising (HRO) and mindfulness as part of the formal curriculum for entry level firefighters. There has been some move away from the earlier classroom based firefighter HRO training and towards the adoption of an increasingly experiential approach. This has included increasing the use of scenario based training and tying the training to tactical decision making. Part of reinforcing the concept of HRO and familiarising has been to include inclusion of the principles into the behaviours exhibited during teaching and incorporating the HRO concepts into other training curricula.

Training Experienced Firefighters

One of the barriers to HRO teaching and learning has been the perception from experienced firefighters that the manner of delivery has been perceived as too condescending and theoretically based. The challenge is to now transfer these theoretical concepts into something more practical.

As a model approach, the National Firefighter Leadership Development Program has brought about a significant cultural change in the service. This was achieved by:

- Placing a field person in charge of the project;
- Using the existing training system, but with new courseware from ex-military resources;
- Using ex-special forces personnel to develop and deliver into the existing training system;
- Introducing course material online; and
- Using other external providers, whilst ensuring QA of material is tightly controlled.

This new way of delivery was originally aimed at incident management team training, but is now expanding to other training provided by the National Wildfire Coordinating Group. This includes:

i) ***The Human Performance Class*** - delivered out of Missoula. This provides two (four week) courses – basic and advanced which are separated by a fire season, giving participants an opportunity to practice the new basic skills in the field before undertaking the advance training. The courses are based around

- Physical capabilities;
- Mental capabilities– delivered by a sports psychologist;
- Dietary practices– delivered by a registered dietician;
- Risk recognition approaches.

ii) ***Facilitated learning analysis course*** (FLA) conducted by Gary Lewis. This is a systems based approach which focuses on lessons learned outcomes, involving a review of an incident with lessons learned then integrated back into the workforce. The course covers the application of the 'After Action Review'; the FLA; and the major incident review. One of the constraints on the current approach is that the FLA does not have a formal follow up process to examine changes in behaviour. However, work has started to examine what sorts of learning is occurring through the different review processes. Recent results show that that there is a 'knife edge' between the need for honesty and the desire for cover-up. This has highlighted the absolute need to ensure that there is clarity about the purpose of the review right from the start. It is critical therefore that there is a clear articulation of the differences between the individual types of review.

New Thinking on Accident Models

In recent years there has been an evolution in how accidents and their causes are viewed. This in turn has resulted in a number of different accident models evolving (Figure 1.3). The latest evolution (performance variability model) is based upon the recognition that accidents arise not as a direct result of bad design or someone's negligence, but rather arise out of a combination of conditions occurring as a result of normal performance variability. This performance variability model considers those conditions that influenced the perceptions, decision and actions of those involved in the incident, by doing so it avoids some of the problems encountered in the more causally based models, such as:

- *Hindsight bias* – creating the belief after the incident that events were foreseeable and/or were understandable at the time;

- *Artificial construction* – the determined 'cause' of an incident is an artificial construction of what was believed to have happened and as such its usually highly simplified and incomplete;

- *WYLFIWYF paradigm* – '*what you look for is what you find*' meaning that attributed causes can often reflect the assumptions that are implicit within the accident model being employed (Lundberg et al, 2009). Each accident model is based upon a set of assumptions about how accidents occur – how a range of different factors may interact with one another and create the circumstances in which an accident can occur. These factors may include, for example, organisational, human or technological factors;

- *Fundamental attribution error* – where cause is assigned to the disposition, attitude or skills of an individual involved and ignores the contribution of the situation in which the individual finds themselves; and

- *Confirmation bias* – where the analyst assigns more acceptance or weight on information that supports their belief or perception, and tends to disregard or downplay information which does not.

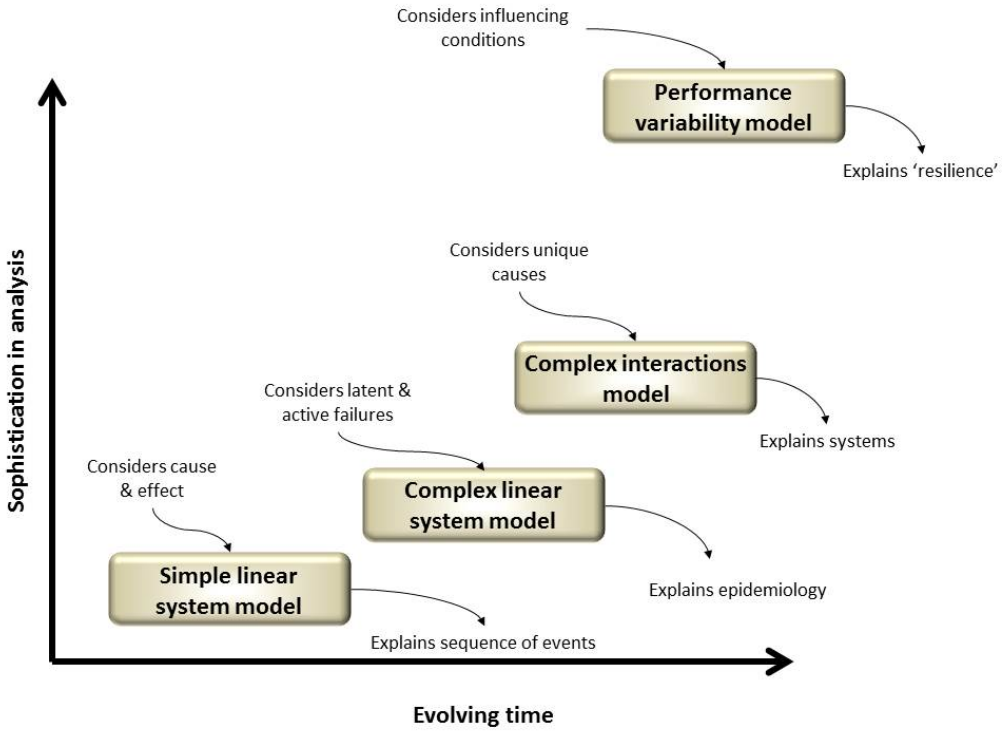


Figure 1.3: Evolution in thinking on accident models

"The craving for cause perverts our understanding of risk"

Steve Holdsambeck (U.S. Forest Service, Intermountain Region, Ogden, UT)

A substantial focus for the work undertaken by the Center has been in moving attention from blaming human error as a cause of failure to accepting a broader system viewpoint. A key to achieving this shift in focus has involved promulgating a wider understanding of the cycle of error (Figure 1.4), where traditionally (and erroneously) 85% of failures have been blamed on human error. The focus on human error has in turn created a predictable set of corrective responses (including 'blame & train'; new rules, procedures and other controls; new technology, etc). Such responses have often made systems more complex and ultimately more brittle, which in turn have

introduced new and different forms of failure. Establishing a broader focus has generated a better understanding of the nature and contribution of failures arising from complex systems.

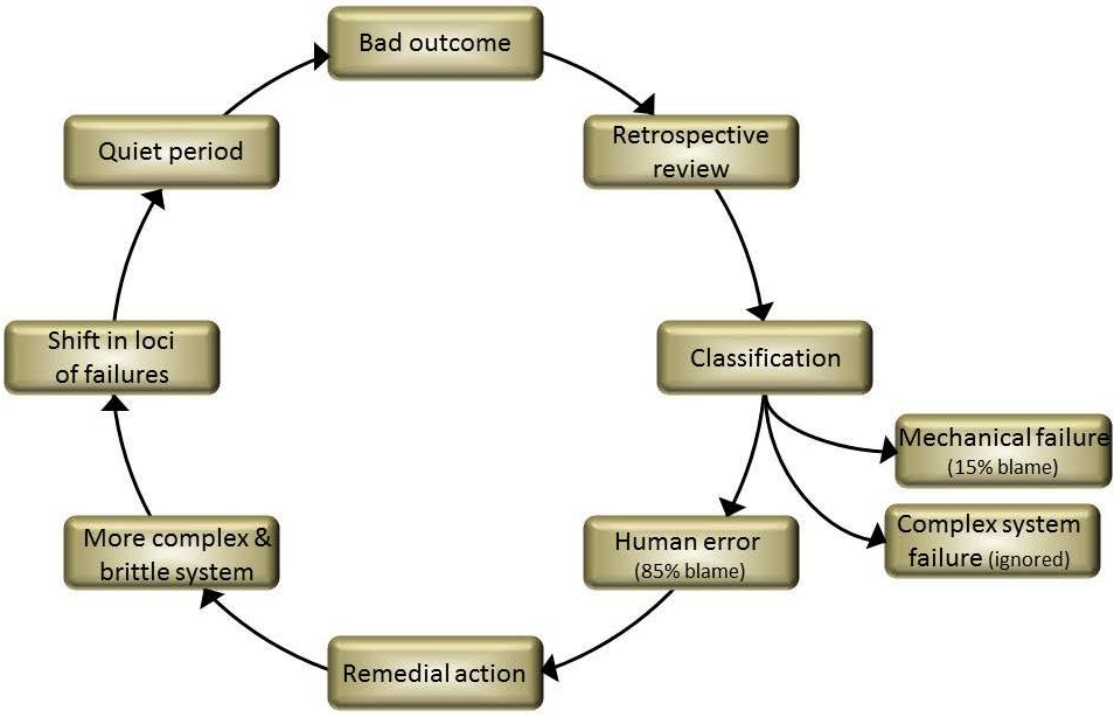


Figure 1.4: Cycle of error (adapted from Cook 2012)

Extending Use of Facilitated Learning Analysis (FLA) for Investigations and Lessons Learned from Major Incidents and Accidents.

The facilitated learning analysis (FLA) was originally designed in 2007 and formally codified in 2010 to provide an ability to learn from the weak signals arising from errors. It has a primary aim of creating a blame-free culture in which errors are acknowledged, openly identified and discussed. Whilst at the same time positive behaviours and actions are recognised and strengthened. The FLA process has been developed to promote individual, team and organisational learning. It is an outcome of the Agency's evolving attempts to create a 'just culture'[1] for its firefighting service. However, if the process uncovers wilful and reckless disregard for safety, the FLA is cancelled immediately and a formal investigation and administrative/criminal actions follow.

Although originally designed as a tool for accident investigation and learning from accident events, it has been increasingly used successfully as a tool to learn from a wide range of other 'surprise' events and 'surprise' outcomes that were not accidents.

Training personnel in the FLA process is undertaken through the use of incident simulations.

In the practical deployment of the FLA, the Lessons Learned Centre is finding that there is a fine balance between the willingness to provide a honest and full disclosure and the desire to cover-up mistakes. They are now trying to move to a more open FLA process through better educating participants about the purpose of the review and facilitated learning analysis.

In its practical use they are finding that there is knife edge between honesty and cover-up by the individuals involved in the incident. The key to move individuals from a 'cover up' mindset to a 'honest disclosure' is through creating clarity about the purpose of the review being used and clearly articulating the difference between the different types of review.

The driving force behind the development of the FLA was a growing dissatisfaction with the existing accident, injury and fatality rates within the Forest Service and the need to organise for higher reliability. Its promotion is based upon the recognition that if the traditional way of dealing with accidents is followed then blame will be assigned, the "guilty punished", only limited learning will occur – until the next accident.

However, the FLA recognises that all personnel operate in an environment of ever emerging and evolving risk, which those personnel need to recognise, make judgments about and adapt to. In such an environment, human performance will be variable and errors will be made. Therefore,

[1] A 'just culture' is where all persons are accountable in a fair manner for their practice of safety in the conduct of their operational responsibilities. The emphasis is on learning from errors and accidents, not on assigning blame and punishment (although deliberately negligent behaviour is recognised and dealt with).

accidents and other incidents can be used to gain a better understanding (both on the part of individuals involved and wider organisation) into how risk is perceived and responded to.

The internationally renowned safety expert Sidney Dekker (2006) expressed this as:

"Take your pick, you can blame human error or you can try to learn from the failure."

A usual outcome from the FLA is the identification of the gap between the risk that command believe is acceptable, and the (usually higher) level of risk that personnel are taking in their operations.

Whilst the FLA was originally developed as an accident investigation and learning tool, it benefits have been recognised in wider application for other incidents, 'surprises' arising from planned activities, or unexpected 'exceptional successes'. One of the key successes is that the FLA process is flexible and expandable to enable it to cope with a wide variety of circumstances from simple accidents to complex major incidents.

The FLA is part of a suite of post event learning analysis tools used by the Forest Service (see Figure 1.5):

- ***After Action Review (AAR):*** focus is on continuous improvement of individual teams and is self-directed by the team itself. The AAR utilises team member discussion to improve individual and team awareness of an event and actions taken, and to identify local operational improvements. This is similar in intent and practice to the AAR conducted within the CFA.

- ***Facilitated Learning Analysis (FLA):*** focus is on broader firefighter learning (lessons learned and shared) and is directed through independent facilitation. It has a strong basis in the willingness of participants to be involved in 'dissecting' an event and to provide honest disclosure of their personal perceptions.

- ***Accident Prevention Analysis (APA):*** is management driven and focuses on organisational learning and accountability. The APA comprises a process that examines organisational and/or cultural factors that have contributed to an accident and could be the cause of future accidents. Note that in the last year or so the APA has begun to be rolled into a more comprehensive FLA process.

- ***Serious Accident Investigation (SAI):*** focus is on developing management understanding and awareness of causal factors and control breakdowns that need to be addressed to prevent further serious accidents. The SAI identifies failures, addresses responsibilities and clarifies liabilities. As such, it has often been used historically to both assign blame and to

defend against litigation. This has resulted in the process being dealt with guardedly by those involved with substantial restrictions on its use for driving sustainable safety improvements.

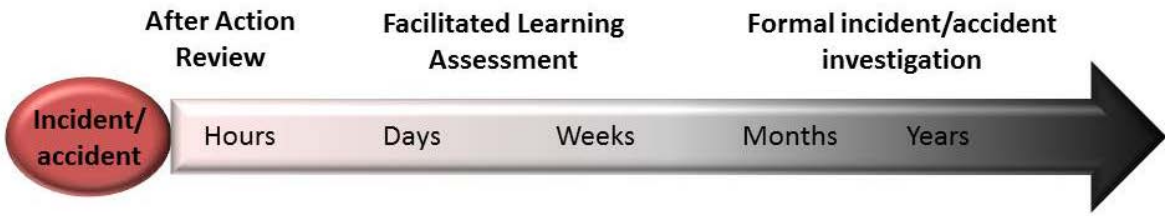


Figure 1.5: Post incident/accident learning analysis timeline

Since both the APA and SAI processes can seek to identify individuals "at fault", assign blame and can generate disciplinary and punitive actions, their utility for addressing the driving causal factors and instituting meaningful safety improvement has been severely limited. Therefore, there have been recent moves to expand the principles of the FLA process into the APA and SAI processes to gain improved witness/participant willingness and involvement (see Modoc investigation below).

Conduct of the FLA

The basic driver for the FLA is dialogue arising from a group problem solving exercise that is founded upon a "disciplined practice of respectful interaction" including trust between the participants and the facilitator. Participation in the FLA is consensual. If any participant seeks to blame other participants they are asked to leave.

Facilitators are chosen based upon their subject matter expertise, independence from the incident and team involved (demonstrable absence of bias), their credibility with the team, and ability to lead a participative learning discussion.

The key to a successful FLA is to ensure that it does not become a long drawn out process with most FLAs (including documenting the outcomes) taking less than half a day.

The key principles upon which the FLA is conducted includes:

- Agreement that administrative actions (including disciplinary action) will not be pursued following conduct of the FLA. This is consistent with the concept of a 'just culture' adopted for example by many airlines. In such 'just cultures' behaviours and decisions resulting in errors or accidents are not punished but used as learning opportunities (the emphasis being on discovering mistakes – not punishing individuals). However, where actions are wilful then in such cases action against the individual can be taken;

- Interaction between all parties involved must always be 'respectful', and is promoted by active listening;

- Learning for the future is more important than assessing and assigning blame for the past;

- There is a recognition that everyone makes errors, and that there is no shame or embarrassment in disclosing these errors;

- That *'bad decisions' are almost always based upon previously learned behaviours and experiences and rarely upon outright carelessness*. It is recognised that accidents arise from combinations of variability in normal performance;

- Safety is not an absolute but is viewed as a reasonableness of risk; and

- Everyone's perspective is sought and considered.

The Detailed FLA Process

Step 1: Decision to form

The initial known circumstances are reviewed by the area senior officers and the decision is made on the need to conduct the FLA. The area senior officers will request that personnel involved 'jot down' their memories of the incident as an aide memoire for later use during the FLA. They are asked to try to not create narrative accounts or build causal relationships at this stage. The use of terms such as 'witness statements' are deliberately avoided at this time. It is emphasised that these 'memory notes' are the property of the individuals and that they should not be given to or read by anyone else.

Step 2. Formation of the FLA team

The size and constitution of the FLA team will depend upon the size and complexity of the incident.

An FLA team may take several days to form and the appointment of an FLA Liaison has been found to greatly assist in keeping the process moving. The Liaison provides communications and support to the personnel involved, particularly where the review is looking at major or complex incidents.

A key factor in driving a successful FLA is the selection of the FLA team, which is based upon the following structure and principles:

- FLA Team members are independent – they have no connections with unit, personnel or event concerned, which could lead to bias or be seen to be preferential or antagonistic.
- FLA Team members have an understanding of the concepts and operations of a 'just culture'.
- FLA Team members have experience of the FLA process, as a minimum having been a participant in one.
- FLA Team leaders should be of equivalent seniority or higher as the leader or supervisor of the unit/team under review, they are accountable for the quality of the FLA review and providing a report to responsible authorities.
- The FLA facilitator is the expert on the FLA process, is skilled in facilitation and active listening techniques, and as the complexity of the event increases, will need to be increasingly expert in accident investigation techniques.
- For complex and/or larger incidents and FLAs, a separate 'reporter/recorder' may be required to document the learnings and produce the written report.
- It is recognised that one of the most effective ways of generating and sharing learning is through narration or 'storytelling'. The FLA process recognises that storytelling is a specific skill and that the conduct of an FLA may require the involvement of such a skilled individual to craft a compelling account.
- Subject matter experts may be both 'peer experts'- i.e. familiar with the roles involved in the incident (e.g. firefighter, crew leader, IMT, etc) or 'technical subject experts' (e.g. hazchem, planned burns, human factors, etc). The choice is based on the relevance to the activities involved in the incident at the time.

Step 3. In briefing

At the commencement of the process, the FLA lead briefs the local area management/ commanders and the individuals that are involved in the incident. The aim of the in-briefing is to develop a common understanding of the FLA's objectives and to agree on expectations of the process.

The location for the conduct of the FLA needs to be considered with care, by considering criteria such as:

- The feasibility of holding the FLA on the ground where the incident occurred;
- Holding the FLA at a location where the participants will feel most comfortable and relaxed;
- Access to aids such as sand tables, projectors, internet access (e.g. for access to satellite images, etc); and
- Logistics of travel to the location for the participants and FLA team members.

Step 4. Conduct of the FLA process

The conduct of the FLA is entirely dependent upon the trust that participants have in the process and in the FLA team conducting the process.

There is also the question of balancing the time and resource commitment of conducting a thorough review with appropriate technical expertise against the need for a speedy completion and freeing up personnel to resume their duties. From a CFA perspective this would be further complicated by the tension of requiring volunteer crews to give up more of their time to participate in such a process.

Information is gathered through both interview and group discussion. Generally interviews are conducted directly with individuals who had direct involvement in the incident, before they participate in group discussion.

Information is gathered with caution as facilitators/interviewers will be subject to hindsight bias, and must learn to manage any subjective opinion that they may have at this stage. It is also important that the facilitators assist participants to develop their own narratives with hindsight bias as limited as possible, particularly by avoiding developing counterfactuals (i.e. what should have happened but didn't).

Step 4 (continued). Conduct of the FLA process

The FLA is conducted around seeking answers to five questions, answers to which are sought by facilitating participants to tell their own story without any correction or critique from the facilitator:

i. The aim of the action/activity:

- What was planned?
- What was the team leader's intent?

ii. Team understanding:

- what information was provided to team members?
- what information do team members feel was missing?
- why could team members not get this information?

iii. Situation:

-what was the situation being faced by the team?
-what did each team member see?
-what were they focusing on at the time?
-were they distracted by anything?
-what were team members aware of that they could not see?
-what did they feel was going to happen?
- did they have any doubts or worries about the situation?

iv. Decisions and actions

-what did each team member do?
-why did they do this?
-what did each team member not do?
-why did they not do this?

v. Learning from the event

- what did individual team members learn from this event?
- what SOPs and training were useful?
- were any SOPs or training problematic?
- what might individuals and the team do differently next time?
- what do individuals believe management should learn from this event?
- what can the broader organisation learn from this event?
- what can the broader organisation do differently now?

Step 5. Reporting

Reports are written to a fairly standardised format (see Appendix A for example) comprising:

i) Type of incident;

ii) Executive summary of the incident and the lessons learned:
- *aim of the action/activity,*
- *team understanding,*
- *situation,*
- *decisions and actions,*
- *learning from the event;*

iii) Detailed description of the overall incident and its outcome;

iv) Chronology/sequence of events:
- including maps and photographs where applicable;

v) The prevailing conditions in the lead up to and at the time of the incident:
- weather,
- environment (geography, topography, fuel, etc);

vi) Lessons learned by the team members (FLA participants) and their recommendations; and

vii) Lessons learned by the FLA facilitator and their recommendations.

The FLA process also attempts to incorporate the principles from High Reliability Organising to enhance the lessons learned (see HRO section below).

The FLA process emphasises the benefit of conducting the process on the ground where the event occurred. However, it also recognises that this will often not be practical. In such cases, where it is "meeting room" based sand tables or satellite images (Google Maps/ Google Earth) are used along with agency and commercial maps of the area.

There are two key outcomes arising from the FLA:
- creation of shared understanding through participation in the process; and
- development of broader understanding in other teams through the generation of a written report.

There is a much lower emphasis on the making of recommendations in the FLA, than is expected in other forms of review and investigation. There is a belief that many recommendations merely shift or introduce new risks, rather than eliminating risk. Creating a compelling learning experience that can be shared is believed to be more effective at creating sustainable behavioural change, whereas recommendations can interfere with this learning. Where recommendations are made, it is advised that these are limited to only those that are essential in shaping future performance or mitigating obvious high priority risks.

Transitioning from a Simple to a Complex FLA

The focus of the simple FLA is on information sought from the observations and experiences of those involved in the incident. In the complex FLA, this focus is widened to the organisational level using a formal lessons learned analysis. The analysis is aimed at developing an understanding of how conditions and mental models (into the lead up to the incident and prevailing at the time) made sense to those involved.

This analysis comprises:

i. Identification of perceptions, beliefs and expectations held by those involved, considered prior to the incident, and whilst experiencing the incident;
ii. Identification of key decisions and behaviours that are proximally linked to (i) above;
iii. Determination of conditions identified through the participant dialogue in the initial FLA. (i) and (ii) above allow a hypothesis around the prevailing conditions to be constructed;
iv. For each of the constructed conditions (iii) answers are sought for the "seven hows", that is ***how*** the individuals involved ***made sense*** of the situation (<u>*not*</u> how it appears to the FLA team in hindsight):
    - How affected individuals made sense of the things they saw and heard;
    - How their expectations arose;
    - How they perceived the risk landscape *at the time*, particularly bearing in mind that hindsight can create a very different perspective;
    - How apparently obvious (in hindsight) risks were ignored;
    - How it made sense to accept risks that appear to be obviously (in hindsight) unacceptable;
    - How it made sense not to enact available hazard /risk mitigations; and
    - How it made sense to not follow accepted procedures or take shortcuts.

The output of the analysis is to determine conditions, not create causal statements, a focus on the latter often developing an overly simplistic view of the situation. The consideration of conditions, not cause, also moves the analysis away from creating counterfactuals (e.g. *"if the incident controller had done this, then that would not have happened"*). The FLA process changes the paradigm from accidents as a result of aberrant decision making and incompetent behaviour to a new paradigm of accidents as a chance combination of ongoing operational variability.

Some of the challenges in conducting an FLA that need to be managed include:

- Deciding if the FLA or some other technique is the right approach;
- Identifying the right mix of skills and personalities to form the FLA team – it is important to have FLA team members that have credibility, can gain the trust of participants, help them to relax, and extract a coherent narrative from them;
- Balancing operational demands on team members and participants with the time needed to undertake a meaningful FLA; and

- Managing the logistics of the FLA, bringing everyone together in the right time and place and keeping them there for the required period of time. Particularly, since experience shows that FLAs invariably take longer than initially planned for.

Solving the Major Problem of Creating Lessons Learned

One of the major problems encountered in the USA with respect to creating effective lessons learned was finding the right motivation for personnel to participate and commit their time. A formal process, such as the FLA, for a major incident or accident, is generally well supported by those invited to participate (usually professional firefighters, who are being paid for their time). However, for more common lower level accidents, incidents and operating performance analysis, the conduct of After Action Reviews is more problematic. A similar phenomenon is seen within Australian services, particularly in volunteer operations. Where, for example, following 12 hours on the fireground and then time taken to make up the vehicle on return to station, the last thing many personnel wish to do is conduct the AAR (particularly if they are volunteers rushing off to their regular employment).

In discussions with US firefighters, the challenge was to find ways in which lessons learned could be identified and captured in a more effective manner, in particular how this could be achieved prior to the return to station.

With respect to wildland firefighting within Australia, one possibility is to introduce an 'In Action Review' (IAR). Wildland firefighting operations readily lend themselves to this type of review where they are typified by periods of intense operational pressure – where errors are being made and temporary fixes implemented on a continuous basis. Much of this learning is then subsequently lost over the following hours on the fireground as fatigue, emotion, and perceptual bias create aberrant memories. However, these types of operations are also typified by regular periods of calm, when crews return to water points to refill trucks and often take the opportunity for rehydration and food.

These periods provide a crew leader with an ideal opportunity to identify issues of concern and gather lessons learned. They provide the opportunity to share sensemaking and to reinforce a common understanding of objectives, barriers, performance, and corrections to behaviours that need to made. A quick two minute IAR can be conducted every time the crew is at a water point, or off the fire front awaiting redeployment. Similar opportunities can be found by strike team leaders, sector commanders, etc to conduct a quick IAR ensuring that lessons can be effectively transferred amongst crews in a dynamic environment. Figure (1.6) provides an example of an IAR pocket aide memoire produced recently for a local CFA brigade. The concept of 'Margin of Manoeuver' is discussed further in Chapter 5.

Figure 1.6: Example 'On Action Review' incorporating consideration of MoM

Training and Development in High Reliability Organising

Dave Christenson with Carl Gibson at the Wildland Fire Lessons Learned Centre

The original concept of high reliability *organisations* was derived from research undertaken in a number of different organisations operating successfully in highly dynamic high risk environments, including on US Navy aircraft operations (Rochlin, Laporte and Roberts, 1987) and later codified into five high reliability organisation principles (Weick and Sutcliffe, 2007). In more recent years, the concept has been adapted to provide more emphasis on teams and individuals, being rebadged as high reliability organising (HRO). The HRO principles have provided a useful foundation for improving fireground safety and operational performance. However, despite their use over a period of years, there has been less success in redirecting large scale behavioural change at the organisational level, and creating a high reliability organisation akin to those organisations on which the original research was conducted.

The various Federal firefighting agencies (and some State and municipal emergency services) have invested significant resources into improving fireground and incident management team (IMT) performance through application of HRO principles.

These principles are being taught to personnel through a combination of channels, including:

i. Dedicated training courses on HRO;
ii. Introduction of HRO principles into other training courses such as FLA facilitators' course;
iii. Introduction of HRO principles into locally based safety and performance improvement training and awareness sessions; and
iv. Incorporation of HRO principles into lessons learned components of staff rides.

These approaches have met with varied success. The dedicated training courses ((i) above) conducted early in the program were successful in creating a range of advocates for the HRO principles, who have subsequently introduced the principles into their own areas of operation. However, this training has not achieved a sustained cultural change as was originally anticipated. The more successful approaches have used the principles to provide structure and/or analytical techniques for strengthening lessons learned in other training approaches ((ii) to (iv) above and also see Chapter 5).

This sort of approach is evident in reconfigured training being delivered in 2013 and for 2014. For example the Advanced Incident Management Course (S-520) has the aim of:

"enhancing Type 1 IMT's performance in complex incidents through bridging the conceptual understanding of High Reliability Organizing with practical implementation demonstrated in HRO behaviors at a performance enhancement level."

Specific objectives of the course are to:

- "*Deepen and personalize their understanding of high reliability practices* (look, feel, utility)".
- "*Deepen understanding of how HRO concepts enrich and link to key leadership skills and team dynamics*."
- "*Develop and use HRO concepts to gain insight into personal and team stress profiles and begin to develop mitigations*".
- "*Gain concrete experience in how these insights can be used to improve sense-making as part of the risk-based decision making process leading to greater reliability*".
- "*Develop a practical personal and team-based 'tickler' list*[2] *for future use*".

The format and content of the course proposed for 2014 is being changed to even further incorporate HRO principles into the key components of the course. The reconfigured training having the objectives of:

- "*To increase ability of the S520 participants to recognize HRO practices and behaviors, particularly in Incident Management*";
- "*To increase participants' familiarity and comfort-level with embodying and encouraging HRO behaviors in themselves and each other*"; and
- "*To help participants see how HRO can help them respond/do what needs to be done*".

[2] Tickler list – refers to a personal aide memoire or checklist.

This approach includes providing increased interactive learning experiences, commencing with HRO –wildfire related case studies provided in pre-course reading material, and carrying this interactive theme through the presentation of the subsequent in-course modules. Previously the pre-reading on HRO was based around the seminal text "*Managing the Unexpected*" (Weick and Sutcliffe, 2007). However, the material is viewed as somewhat abstracted from operational practicality. The focus has moved away from a study of high reliability organisations to high reliability organising. That is from the study of the subject of HRO to better understanding how high reliability enhances the effectiveness and efficiencies of incident management teams. This is also linked to increasing the satisfaction of course participants to better improve their retentiveness.

Based on HRO principles, a set of desired behaviours has been established for incident management teams (see inset below- Incident Management Team HRO Behaviours[3]).

[3] Insert information is sourced from USDA Forest Service, Lesson's Learned Centre

Incident Management Team's HRO Behaviors

Acting With Anticipation

Exhibit behaviors and enact processes to improve their capabilities to anticipate and become aware of the unexpected early. When these principles are expressed in IMT practices, members do such things as these (examples):

- When applying the risk management process, go beyond assessing observable hazards by asking, 'What is/are the worst thing(s) that could happen?' and manage the risks associated with those identified contingencies by asking "What is undesirable about that?" "How can we see it early?" "What might we do?"
- Conduct 'practice runs' in the form of before action reviews (BAR) and other thought exercises designed to uncover and plan for potential failure points.
- Include an interactive component in all briefings, during which briefing recipients are expected to ask questions, challenge assumptions and provide new information. Expect that this interchange may result in immediate course correction.
- Make their assumptions explicit when engaged in decision-making and when communicating decisions to others. Ask other team members, briefing participants, agency administrators, etc. to question assumptions, identify potential unintended consequences of decisions.
- Are actively observant for small deviations from expectations and communicate those deviations upward, downward, and laterally.
- Is attentive to stress responses in self and others; responds to decrease reactivity; improves quality of communication; addresses need to for explicit or implicit calls for support (i.e., overwhelmed, fatigue, etc).
- Discusses all close calls in AARs regardless of apparent severity; expect their subordinates to do the same.
- Actively ask others to question assumptions, provide new information, report problems or failures candidly. Does not respond defensively when others do so.
- Encourages a climate of healthy scepticism. For each operational period, the IMT publicly appoints a designated sceptic to ask 'what if' and to poke holes in the plan. Members frequently check-in with others and ask "What's going on?" "What am I/we not seeing?" Are sceptical of quiet periods. IMT models this behavior by playing devil's advocate, but explain to others what they are doing and why.
- Uses their prior experience as an *initial starting point*, for decisions and ask "How does the actual situation we face differ from the one in my experience?"
- Employs practices that allow varying perspectives to be voiced openly and understood adequately in order to surface information not held in common. In the process, people manage differences effectively.
- Develops and maintains a common and thorough awareness of the operating environment, planned and ongoing operations; with the objective being a shared understanding of the operation, and factors affecting the operation, at each moment.

Incident Management Team's HRO Behaviors

Acting for Containment:

HROs invest more of their resources to help people contain and bounce back from unexpected events after they begin to occur. When these principles are expressed in IMT practices, members do such things as these:

- Actively seek to understand the type and location of expertise within the organization. Employs or draws on this as needed to ensure that decisions are made by appropriate experts.
- Establish an 'incident within incident' protocol. Communicate the protocol as well as train and drill on its use. Employ it as needed.
- Pay attention to the quality of relationships. Quickly identify and seek to improve less-than-effective working relationships.
- Openly discuss stress reactions with others. Address need for explicit or implicit calls for support and/or needs for intervention.
- Use slack time to practice and develop skills. Develop capabilities for swift learning, flexible role structures and quick size-ups.
- Encourage and initiate stretch assignments, frequent job rotation, and cross-training.
- Routinely initiate check-ins with others.
- Communicate openly and share knowledge widely so that people up and down the line are aware of the full picture – desired end state with 'why' as well as 'what', and understand their role in success. Establish such communication and information sharing as an expectation.
- Knows where various expertise exists in the organization and develops the capacity to bring people together quickly to address an emerging problem.
- Understand "the system of systems" for dealing with serious events investigation, critical incident stress management resources, organizational learning protocols, etc).
- Willing to begin treating an anomaly even before a full diagnosis is available. Tries different tactics to learn more about the actual situation and system behavior (e.g., small action, pilot test when possible).

Promising results have been obtained through 'in action' HRO development. IMT's on deployment to major fires have been on occasion subject to 'observer review' by experienced members of the Lessons Learned Center. The objective of these observer reviews has been to improve the mindfulness of an IMT and build upon the HRO skills that are already being used during that deployment. In particular this has involved helping IMT members to recognise and continue to expand their use of helpful adaptive behaviours and attitudes, whilst understanding and lessening their dependence on potentially harmful behaviours.

This approach requires a highly skilful observer/coach, who can tactfully and unobtrusively insert themselves into the IMT and who is able to recognise the right learning moments during an operation when an early focus and guidance can be provided. This is a balance to ensure that IMT members are not distracted from the key priorities of managing the incident or from being overwhelmed by new information and concepts being provided.

A similar role, that of 'trusted mentor', was introduced into Canterbury University's IMT during the Christchurch earthquake disaster. By being independent of the IMT they were able to step back from its decision making and provide unfettered independent advice during its operation.

These principles have also been used to help embed an understanding of the ETTO concept – '*Efficiency Thoroughness Tradeoff*' (Hollnagel, 2009). ETTO describes the balance in decision making and operating between being efficient and being thorough. For, example as efficiency increases, thoroughness decreases. 'Efficiency' is focused on using available time (and often reducing it) to implement plans and perform actions. Conversely, thoroughness is about creating time to think, to recognise and understand the situation, to make decisions about it, and to create plans for the future. If efficiency dominates, there will be too little time spent on thinking and planning and the activities being undertaken may be poorly planned or inappropriate to the situation. Where thoroughness dominates, there will insufficient time and resources for actions to achieve their outputs.

At an organisational level, an increasing drive towards 'primary' strategic and operational objective achievement tends to reduce attention towards other (often perceived 'secondary') objectives such as safety. At a personal level, for example, this can result in individuals making short cuts in decision making in order to reduce overall time on a task - "to get the job done quicker".

From a strategic perspective there is also the paradox that to really achieve efficiency in the present, we would have needed thoroughness in the past, and to achieve efficiency in the future we will need thoroughness in the present.

The HRO Concept: The Five HRO Principles

1. ***Preoccupation with Failure***:

This involves the creation of more anticipatory thinking, which is concerned with understanding how failure could occur and how it can be identified. Central to this is an understanding of the sources of error (Figure 1.7), which can derive from single or multiple factors, including:

- The nature of the task being undertaken;
- The work environment within which the task is being undertaken;
- The competencies of the individual(s) to undertake the task; and
- The psychology of the individual(s).

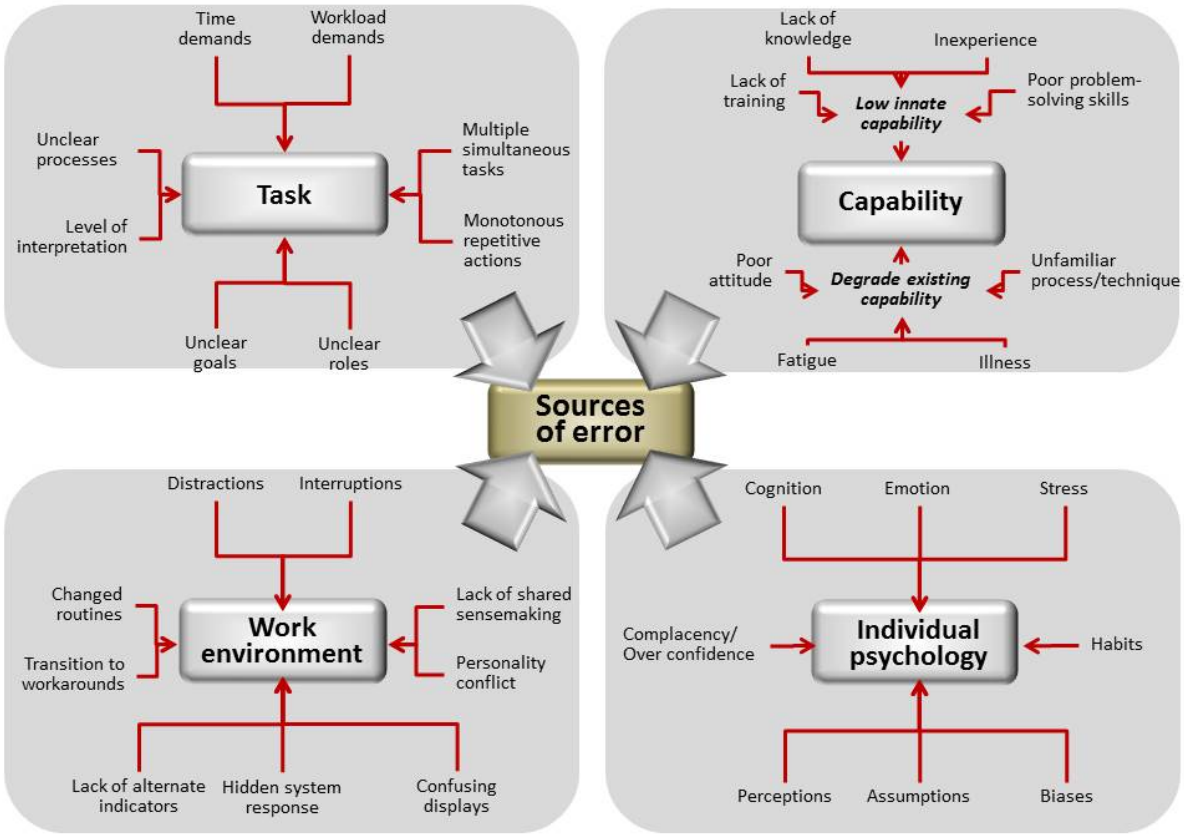


Figure 1.7: The sources of error

A crucial understanding is that errors occur all of the time. Many of these errors go unobserved and can remain 'latent' creating conditions that can allow further errors and, as more errors accumulate, can lead to a catastrophic failure.

Research in front line operations shows that more error resilient crews can be trained to practice behaviours which proactively help to manage errors rather than just reacting to them. Such behaviours include:

- Continually evaluating problems and putting in place self-corrections, for example, through regular after action reviews, FLAs, etc.;

- Understanding and practicing standard operating procedures;

- Continuous communications at multiple levels;

- Operational planning activities carried out with the crew, which also include discussion of potential errors and contingencies.

The core aspect is guiding all members of a team to more actively think about the possibilities of errors and to more actively look for them. This means becoming more involved in a continuous process of looking for the (usually weak) signals of failure and being constantly aware of the things that could go wrong. This involves:

- Clearly articulating the mistakes that individuals/groups ***do not*** want to make, in pursuing their objectives, prior to an engagement;

- Creating a collective sense from the perspective of each individual involved;

- Having all individuals involved in actively looking for things that are not going according to plan (including small lapses and errors). The key is getting individuals to notice more about how the group is performing and the environment around them, and notice these things more often. This is counter to usual human behavior were we routinely looking for evidence that confirms, rather than challenges our beliefs. The 'generally experienced' view then tends to discount information that does not meet expectations. Preoccupation with failure is about turning this around – paying more attention to the details of the unexpected, whilst errors are still small and manageable;

- Encouraging individuals to speak up about things that are creating concern or don't make sense for them. This is driven by leadership, the creation of trust, and rewarding disclosure rather than punishing admission of error;

- Watching and tackling complacency within the group, creating gaps in understanding, missing key indicators of changing circumstances;

- Ensuring that lessons learned are integrated into improved systems of work, processes and procedures; and

- Taking advantage of ‘quiet periods’ in operations to consider what each individual may be missing – defining what are they not seeing in the changing environment.

The outcome from creating more anticipatory analysis of performance and environment is to improve the flexibility of both decision making and action in response to the small early warning indicators of significant change that is emerging.

In practical terms firefighters are asked three questions:

- “***What*** do crew members count on?”
- “***What*** do crew members expect from the things they count on?”
- “In ***what*** ways can the things crew members count on fail?”

Note this approach focuses on ‘***what***’ can fail, not ‘***who***’ can fail.

Common types of errors include:

- Assumptions about a situation are made that are incorrect;
- Information is incomplete because important details are overlooked;
- Available information is misinterpreted;
- Information that is communicated is misleading or confusing; and
- Valid information is ignored or disregarded.

Taking it and Making it Personal

In common with many of the principles considered in this report, the success of the techniques depends on them being taken from a theoretical concept and being made more practical and personal.

To enhance a focus on better thinking about errors, encouragement needs to be given to change personal behaviours and attitudes. This could include:

- Having the leader specifically asking team members to bring back to them any bad news as it arises;
- Not only providing goals and objectives to be achieved, but also explicitly stating how tasks are NOT to be undertaken, and what mistakes are NOT to be made;
- Actively seeking out 'bad news' by asking individuals: "what has gone wrong", "where has it gone wrong", "how could it go wrong";
- Listening for questions that have not been asked but should have been asked; and
- Rewarding individuals for speaking up, even with just a simple thanks or other acknowledgement, in front of other team members.

2. Reluctance to simplify

This is closely interlinked with "preoccupation with failure" and involves making individuals and groups more aware of the problems with simple interpretations of what they are experiencing. Most situations faced by first responders will either be complex, or will have the potential to rapidly become complex. The essence then is to encourage individuals not to try to unnecessarily over simplify the situation, and hence lose meaning. The primary concern is with ensuring that the detail and nuances of a situation are not lost as individual and group sensemaking naturally trends towards creating a 'black and white' view of things. It is about recognizing that key information, particularly with regards to small deviations from the normal, often resides in the 'grey'.

Such problematic simplification often occurs when we are faced with circumstances that appear familiar with previous experience. We then tend to simplify our understanding of the current situation based on this previous experience and received wisdom. In such circumstances it is important to recognise the need to question constantly any such received wisdom upon which we may rely.

Furthermore, by simplifying we can omit information on critical differences, which do not then become part of our sensemaking. Part of creating this reluctance to simplify includes encouraging different views and actively questioning 'received wisdom' and questioning assumptions. It is about trying to find the space to seek a diverse range of perspectives and to question assumptions. Fundamentally, it is about being able to effectively reference previous situations and experiences whilst still being able to assess each situation on its own merits. It is about determining what is being observed, whilst also identifying what is not being observed.

3. Sensitive to operations

Sensitivity to operations reflects the need for everyone, at all levels, (not just the front line operators) to be aware of what is actually happening. Not just what they assume is happening. In particular, paying attention to how systems, processes, procedures, capabilities, workloads and resources are coping with the changing circumstances. Being sensitive to operations means considering the quality and effectiveness of interactions between and amongst all of these operational elements. Such sensitivity is not a 'one off' activity, but should be a continual activity. It becomes a continuing process of checking assumptions against reality. It is about 'paying attention to the front line' through being sensitive to both the systems (being aware of how deviations from expectation are occurring) and to how relationships are functioning.

4. Commitment to resilience

Commitment to resilience is focused upon maintaining capabilities that allow individuals, teams and/or organisations to respond flexibly and with agility to errors and incidents. It is based upon the recognition of, and acceptance that things can and will go wrong, and that the organization and its people need to be prepared for when this happens. It therefore encompasses the dedication of time, resources and leadership to promote adaptive capability development before, during and following incidents.

5. Locate and defer to expertise

There is a recognition that higher levels of expertise are not always associated with seniority and hierarchy. The most effective expertise often rests with those with the best perspective. Therefore, as circumstances change across, up and down the team or organisation, so the location of appropriate expertise will also change. Deference to expertise therefore becomes an active process of monitoring environmental volatility and changing skill needs and seeking out the right kind of expertise needed for that time. This will often involve the transition from formal authority to "hands-on expertise".

High reliability organising: summary of principles

i) **Preoccupation with failure** - understanding that over time errors will occur and accumulate, being aware of what could wrong, being aware that we might have missed something, and being able to identify the signs that show these errors ,and being able to act before something goes wrong.

ii) ***Reluctance to simplify –*** being aware that driving increased efficiency is often achieved through simplification, too much simplification means that we may miss key indicators of variability.

iii) ***Sensitive to operations –***being aware of and understanding what is occurring in the execution of objectives – how operational performance varies with changing circumstances.

iv) ***Commitment to resilience*** – have systems, resources, capabilities and practices that are flexible to adapt rapidly to changing circumstances.

v) ***Deference to expertise*** – being prepared to loosen rigid hierarchies and allow those with appropriate expertise in the moment to lead and make decisions.

The 5 HRO principles can provide an increased understanding and capability to improve reliability in dynamic high stress environments. However, the 'HRO' movement has focused so intently on these principles, that consideration of other equally important factors has been somewhat ignored. The HRO principles provide important contributions, but are only part of how an individual, team or organisation makes sense of a situation, makes decisions and acts to change behaviour based on that sensemaking and decisions (Figure 1.8).

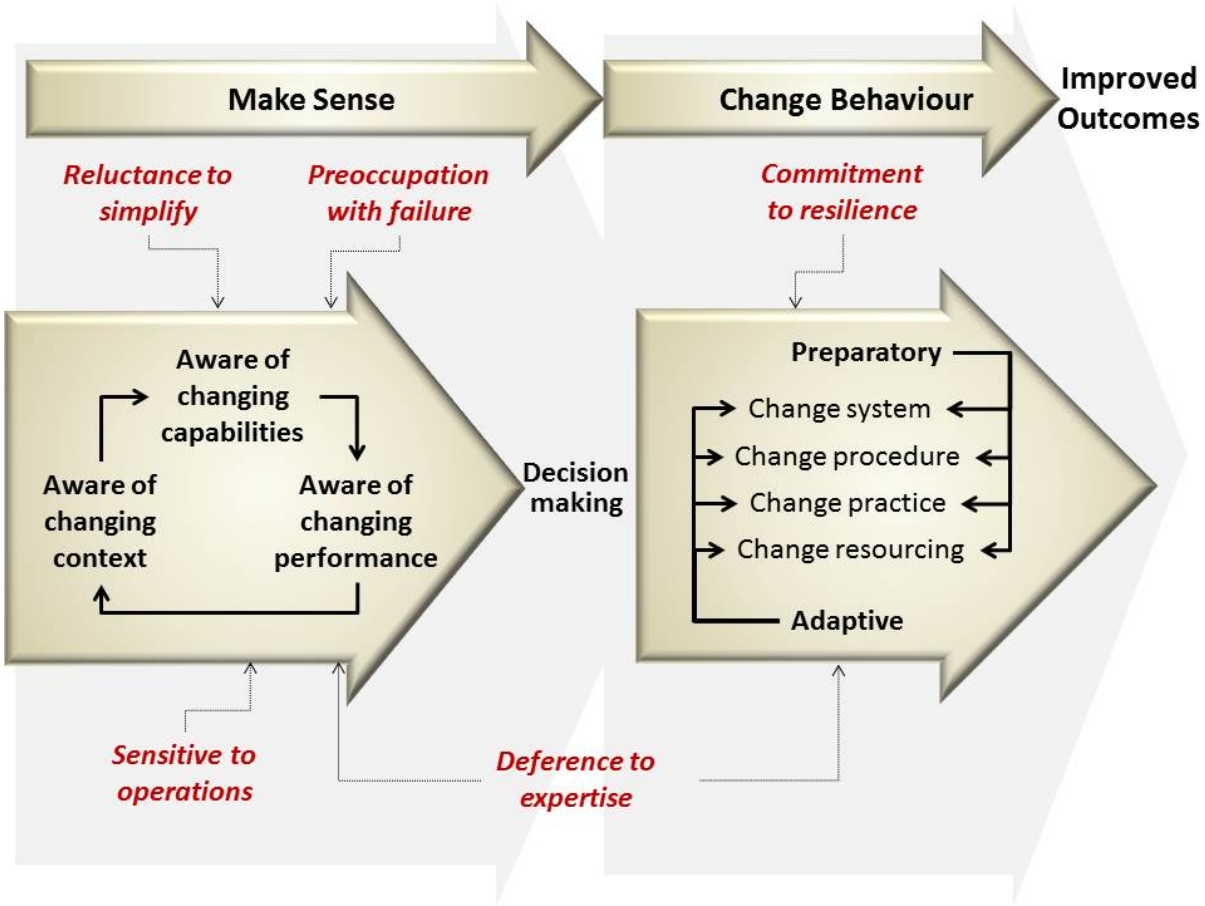


Figure 1.8: The contribution of HRO to wider aspects of sensemaking and behavioural change

With several years of HRO training of front-line fire fighter and IMTs, there is substantial anecdotal evidence of changing behaviour and performance in operations. This has included:

- Firefighters having a better understanding of the limitations of their pre-existing mindsets adversely affecting their situational awareness and broader sensemaking of situations. This includes some understanding of the beneficial and harmful effects of stress;

- Teams/crews are more accepting of the need to consider alternative approaches in operations and to look at their mistakes and learn from them;

- Those in leadership and supervisory roles encouraging their teams/crews to more proactively search for problems and to be more vocal in sharing what they are perceiving and thinking;

- An increased emphasis on continuing skills development, that goes beyond the traditional set of operational competencies. For example, learning that includes risk perceptions, cognition and decision making under high stress situations, the nature of errors and near misses;

- Improved monitoring of change in both the environment and internal capabilities and performance during operations;

- Improved communication, information sharing and developing connections. Including an improved willingness for those more senior to listen to their teams/others and include them in the decision making;

- A stronger willingness to question 'received wisdom' particular when it does not seem to make sense in the conditions being experienced; and

- Improved team/crew culture that is more honest, open and trusting, along with the recognition that everybody influences each other's performance.

Research conducted with the US federal Fire Community (Black, 2013) identified 5 pillars of high performance that are strongly interlinked with the HRO principles:

- Mindful, broad situational awareness and connection to other levels of the incident;

- Leadership, for example how the leader encourages differing views and questioning from their team;

- Group culture;

- Learning Orientation - how a group of individuals learn as a team;

- Mission clarity and competence, how clear the objectives are to teams at the commencement and at the close of operations; how these objectives then fit into the broader organisational goals.

HRO: Operational Training

Training of operational personnel at a local (interagency) level has centred on three components of creating a safe and productive unit:

- Establishing respectful interaction within and between teams, based upon honesty, trust and self-respect;

- Developing supporting cultures based on:
    - open and timely reporting, where team members are willing to share their concerns,
    - a fair and just culture, where feedback is respected and mistakes are not punished,
    - a learning culture, where all members of the team see that they gain benefit for continuous learning. The emphasis being on individual learning becoming a natural activity that becomes essential to professional and personal growth.
    - flexible and adaptable culture, based on the recognition that procedures and rules cannot cope with every situation; and

- Adoption and implementation of the five HRO principles.

Individual training courses are adapted to meet the learning needs of the different compositions of groups that go through training, but are based around a common 'vanilla' curriculum (see inset box).

HRO curriculum: 1 to 2 day training – provided to all levels

1. **Introduction: setting the stage**

- ***Why HRO is important to you?***
    - Changing operational context;
    - Decreasing tolerance for error;
    - The need for better learning experiences;
    - The transition from novice to expert;
- ***What is different about HRO?***
    - HRO and the development of mindfulness;
    - Creating "novel distinctions";
    - Capturing weak signals;
    - 3 principles of respectful interaction (trust, honesty, self-respect);
    - Concepts of an informed culture (just culture, reporting culture, learning culture, flexible culture).

2. **HRO audits**
    - ***Reflection on HRO***
        - Using Weick and Sutcliffe's HRO audits to examine the climate and status of participants organisations.
3. **Exploring the 5 HRO principles**
    - Tracking Small Failures;
    - Resist Oversimplifying**;**
    - Be Extra-Sensitive to Operations;
    - Maintain a Strong Capability for Resilience;
    - Take Advantage of Different Levels of Expertise.

4. **Practical applications**
    - Using case studies to explore the principles:
        - Sand table exercise;
        - I-90 fire shelter deployment;
        - Little Venus WFU entrapment;
        - New York Peak burnover;
        - Non-wildfire examples:
            - New York Trade Center attack;
            - Texas City Oil Refinery;
            - Columbia Space Shuttle Search and Rescue Incident.
5. **Closing and wrap-up**
    - Personal reflections HRO;
    - Practical application of HRO is the workplace;
    - HRO resources for further learning.

HRO Workshop: Senior operational staff introduction to HRO

Provided to Battalion Chiefs

Session 1: 45 minutes

Intent and Purpose: Answer the question, "Why should I care about this?" with the first presentation.

Workshop Overview: ***Mindfulness*****:** building an improved infrastructure on top of what you already have.

Session 2: 60 minutes

Phase 1

Anticipation: Seeing things coming early enough to intercept problems before they get big.

Brain Rule on Vision: tops all other senses (memorable, but not always completely accurate):

- **Visual Cognition:** what focusing sometimes does for us
- **Tracking small failures**
- **Resisting oversimplification**
- **Sensitive to operations**

Phase 2

Human Factors: Understanding the real limitations of our Human Nature.

Session 3: 60 minutes

Phase 3

Resilience: Increasing the individual, unit, and organization's abilities to "take a punch" and come back quickly.

After Action Review using the "original AAR Process".

Follow Up Q&A

Resilience Engineering

The Lessons Learned Centre is incorporating concepts form the growing body of research in resilience engineering (reviewed in Hollnagel, Woods and Leveson, 2006; REA, 2013). Whilst the primary focus of much work on resilience engineering has been focused on systems of safety, this work is also making substantial contributions to improving sustained operational performance under high stress situations.

In these cases, resilience (and the opposite end of the spectrum – brittleness) are exhibited when an organisation or team is subjected to a stress challenge. Under such conditions, where resilience (rather than brittleness) manifests – the key issue becomes the ability of the organisation/team to know where the critical risks are and when to start to tighten control over these risks. Thus resilient organisations and teams demonstrate:

- The ***ability to anticipate and recognise*** changing conditions and how this will affect operational goals. This involves being able to construct *plausible* future scenarios (for both the immediate operations and also farther out into the future), to detect change happening, to recognise the change and to be able to assign some level of importance to it. This includes proactively looking for indicators that the nature of risk is changing. Such indictors may include:
    - the scope of required actions suddenly and unexpectedly increases,
    - multiple issues requiring attention begin to emerge,
    - progress on actions/performance begins to fall off,
    - timelines are not being met,
    - unexpected demands for more resources,
    - communications begin to change, become more frantic or alternatively become substantially less frequent,
    - individuals becoming highly fatigued and/or stressed;

- Timely ***monitoring of change*** and its impacts, and any variability in the organisation's performance. In a dynamic environment, the usefulness of traditionally used lag indicators declines dramatically. Effective monitoring depends on the ability to identify and interpret lead indicators that can function as reliable forewarnings of change that is about to happen;

- The ability to ***respond to change and to adapt***. All organisations respond to regular variability within their internal and external environments. More resilient organisations are better able to respond to increasingly irregular variability. This requires an understanding of both 'how' and 'when' to act, which then requires the capability and resources to action the required response; and

- The ability to ***learn from successes and mistakes***, and to incorporate these learnings into continuing improvements. A particular focus is on changing behaviours to better achieve desired outcomes, importantly – *learning what is meaningful*, rather than (what often occurs) *learning what is easy*.

The teaching provided to operational teams focuses on:

- Regaining the '***big picture***', involving:
    - making a conscious decision to stop what they are doing and look at what is happening more broadly than their immediate task. For example, it is in this respect that the 'SHARP' tool is finding use,
    - nominating an individual to purposefully step out of their usual role and keep coming back to the broader perspective,
    - look at where breakdowns in capability and performance may be occurring and identify where further breakdowns are likely to occur, and
    - reassess the risks and the task objectives and realign to meet the changing conditions;

- Establishing a '***buffer***' **capacity to handle increasing demands, for example by:**
    - identifying **a**reas that pass their capacity or are being overwhelmed,
    - shedding workload: by stopping unnecessary activities, declining additional lower priority tasks and focusing only on what is necessary,
    - increasing capacity, through redirecting resources or by tasking additional resources,
    - expanding capacity limits, for example by managing fatigue and other stressors;

- Shifting roles by focusing critical resources (unique expertise, key equipment, etc) on critical tasks and use less specialised resources (less skilled personnel, plentiful equipment, etc) on activities with less complex demands.

Conclusion

Over recent years there has been a change in emphasis from high reliability organisations (whole of entity perspective) to high reliability organising (individual and team perspective). Although there have been several years of training in HRO principles with evidence of some operational improvement, there is still a significant gap between the fire services performance and that of iconic HRO exemplar organisations.

The training has created a large number of advocates across the States (at Federal, State and local municipality levels) that have continued to promote HRO principles and practices within their own areas of responsibility.

One of the constraints in the approach until recently appears to have been the relatively abstracted nature of the content of training which has been based very strongly upon the theoretical concept of the 'founding fathers' of HRO (including involving Karl Weick and Kathleen Sutcliffe in the establishment and early delivery of the training program).

Feedback from operational personnel has been that whilst they can see the benefits of the concepts, they have been finding it difficult transferring this knowledge into an operational setting. More recent developments have started to address, in particular a move away from 'pure' HRO training, to integrating the principles and practices into a more multidisciplinary program. This includes the recent development of the 'Margin of Manoeuver' concept (see Chapter 5).
There is substantial growing interest in applying emerging findings from psychology, cognitive science and neurosciences to teaching and learning practices, and into developing strategic, operational and tactical capabilities.

This has included findings from the field of social intelligence, in particular the phenomenon of 'mood contagion' whereby positive and negative behaviours (particularly someone in a leadership role) can trigger similar behaviours in others. A social competency inventory has been developed to enable these influencing behaviours to be examined and to help put in place strategies to better promote the desired ones.

Neuroscience has also revealed that within the human brain there exist two distinct neural networks that are associated with two unique leadership styles: task-oriented and one socio-emotional oriented. These networks and their behavioural modes are antagonistic towards each other; as one increases in dominance, the other mode becomes suppressed. Whilst the brain flips between these modes several times every minute in normal circumstances, depending upon the mental state of the person and the pressures of the environment, one mode can become dominant for prolonged periods and an individual can then become stuck in one of these modes. This has obvious implications for leadership and team management.

If someone becomes too dominant in the task-oriented mode, they become narrowly focused on a specific action, lose empathy and start to ignore people issues. Conversely, if the socio-emotional mode dominates, there will be substantially less focus on the task and a subsequent drop off in performance and an increase in errors. Effective leadership needs these two modes to be balanced. This can be achieved through better awareness of how the mind and brain operate, to allow the

individual to recognise when one mode may be dominating; and by training in techniques that reduce the effort required to switch between modes.
Training has been conducted in the new SHARP concept to improve individual's awareness of where their attention is being directed, and how their current experiences are affecting their emotions and cognition.

Over recent years new thinking on accident models has emerged and has been incorporated into the way that errors and accidents are considered and there has been a drive to move organisational culture from one of 'blame' to a 'just culture'. Although not universal within the service, there is growing acceptance of the idea mistakes need to be regarded as triggers for learning not punishment. One approach contributing to this has been the Facilitated Learning Analysis used for capturing lessons from accidents. The 2013 fatalities at Yarnell Hill (Arizona) and Saddleback (California) have been influential in creating the next evolution of this in the form of the 'Learning Analysis' pioneered by Ivan Pupulidy (see Chapter 5).

Implications for the CFA and Other Emergency Services

The Study has highlighted the benefits of increasing the awareness of personnel about more contemporary thinking on the nature of error and accidents. Thus introducing them to some of the thinking about strategies and practices for reducing error, improving safety, and enhancing overall performance.

My observations are that optimum benefits can be achieved through providing training to personnel at all levels and in all areas such as:

- How the brain and emotion influence risk perception, situational awareness and decision making;
- Principles and practices for early identification and resolution of errors;
- Improved methods for capturing learnings from operational experiences.

Whilst not advocating the extensive training programs being provided in the USA, I believe some real benefits to introducing these principles and practices through:

- Intensive short seminars;
- Their incorporation (as short focussed sessions) into existing training programs (both class room and field based);
- Providing online resources for self-directed learning.

- Introducing new practices and providing aides such the “On Action Review Card” to allow learnings to be captured during a deployment.

Whilst the focus of this part of the Study has been strongly oriented towards fire services, many of the principles and practices are directly applicable to other emergency services, particularly with respect to leadership and supervisor development, and in the operation of incident management teams.

Chapter 2: Fostering Mindfulness, Understanding Emotion and Managing Stress

Rocky Mountain Research Station, Ft Collins, Colorado

Host: Jim Saveland: Program Manager Risk Management, USDA Forest Service

The purpose of meeting with Jim Saveland was to examine:

- The role of mindfulness in improving sensemaking and situational awareness in operations;
- The benefits of mindfulness for improved management of stress and recovery from traumatic stress;
- Different mindfulness approaches used in other sectors, such as the US military; and
- Potential new approaches to make mindfulness more applicable to, and accessible for emergency services personnel.

Improving Consideration of Stress

The Role of Stress

Stress is an ever present factor experienced by all operational personnel. Although stress is normally equated with adverse circumstances and harmful consequences, some stress is beneficial and even essential to high performance. Stress is a natural arousal response to non-routine stimuli, in itself it is not necessarily intrinsically harmful. The stress response has provided us with an evolutionary advantage (particularly in terms of the flight or fight response) and is a continuing need of human psychological and physiological maintenance and growth. The triggering of the stress response involves the release of a hormone – epinephrine which creates a range of physiological changes, including increasing the ability of muscles to respond faster and work harder (at least for a short while) and for the mind to become more focused and attentive on the matters at hand (improved situational awareness).

However, problems arise when the stress level becomes too elevated and too prolonged, causing the increasing release of another hormone – cortisol which when chronically present creates a range of harmful effects. Cortisol initiates a number of harmful physiological changes that:

- Increase fatigue;
- Depress cognitive skills;
- Lessen emotional control; and
- If too prolonged will adversely affect the immune system.

Research has shown that chronic stress damages directly an area of the brain, the hippocampus, which plays a major role in memory development and learning. The effect of stress on the hippocampus causes it to atrophy and shrink with a resulting measurable memory loss (Bremner, 2005).

Even short intense periods of stress can have a profound deleterious effect. Research into the behaviour of financial traders responding to the pressure of dynamic financial markets showed temporary increased levels of testosterone significantly altered decision making (reviewed in Coates, 2012). This work demonstrated that the rapid increase in testosterone, released as part of a stress response, adversely interfered with decision making processes, significantly increasing inappropriate risk taking behaviour. Too much stress can have a range of possible affects including becoming 'task saturated' or overwhelmed, burned-out, unable to concentrate on priorities, increased emotional amplification of decision making, increased anxiety, impatience and aggression (See Figure 2.1). Such reactions to stress, as well as affecting directly individual performance, can have a profound deleterious effect on team communication and cohesion.

Conversely, too little stress results in individuals becoming bored and complacent, with decreasing attention to detail and increasing carelessness, thereby increasing the likelihood of errors.

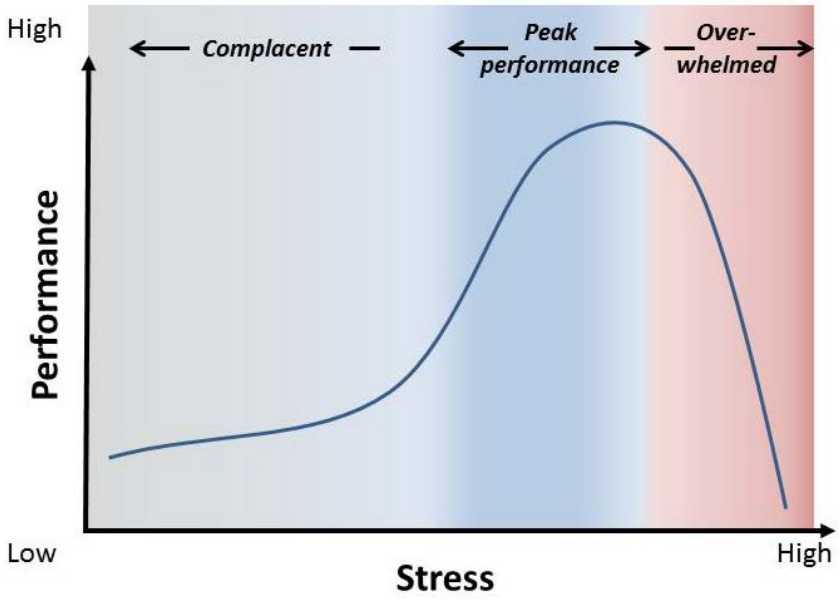


Figure 2.1: The effect of stress on performance

In addition to the stress arising from a current situation (in the moment), stress is cumulative, it builds up over time. An individual could be faced with stress over preceding weeks, months (or even years) arising from other work situations or in their personal lives before there is a noticeable problem. Such stressors will gradually add (usually unrecognisable at the time) to an individual's stress load with increasing adverse effects on health and behaviour. This means that someone can have a severe stress reaction occur in an otherwise relatively benign situation.

Typical reactions to stress

Awareness and cognition:

- Disorganised thinking
- Confusion
- Inattention
- Tunnel vision

Behavioural:

- Irritability
- Impatience
- Aggression
- Increased alcohol consumption
- Excessive talking / use of humour
- State of denial
- Freezing up

Physiological:

- Nervousness
- Nausea
- Increased perspiration
- Tremors
- Increased heart rate

Recognising and controlling stress in oneself and in other team members is essential to maintaining high performance and overall team safety. Managing adverse stress is achieved through replacing current ineffective coping strategies with more effective ones:

- Emotion focused coping strategies – reduce or redirect adverse emotional response to stress – includes improved health (e.g. through better exercise and diet) and mindfulness techniques;

- Problem focused strategies – attempting to control the source of the stress reaction. This includes – confronting the stressful situation, reducing uncertainty regarding the situation, planned problem solving activities.

The commonest stressors facing front line personnel are in fact also those are universal in most industries:

- Role ambiguity and role conflict;

- Conflicting expectations, within hierarchies and amongst team members;

- Perceived lack of control, over the nature of the work being undertaken, of the broader job and in personal life;

- Conflict between the goals of expectations of the job and personal values and beliefs;

- Perceived lack of social support, from peers, supervisors, friends and family.

Based upon the work undertaken with the Rocky Mountain Research Center, as part of improving fireground safety, a pocket aide memoire on stress[4] (Figure 2.2 and 2.3) is being piloted with local CFA volunteers (Benloch Brigade, Kyneton Group, District 2).

Figure 2.2: 'Managing Stress' aide memoire pocket card

Figure 2.3: 'Staying SHARP' aide memoire pocket card

Critical Incident Stress

In the creation of 'normal memories' two systems within the mind interact: the cognitive memory system (creates facts, organises memories and establishes a context for those memories), and the emotion memory system (creates an emotional overlay for memories which enriches the quality of the memory and can provide triggers for recall). Memories are not stored like photocopies, but are recreated each time they are remembered by these two systems linking together bits of information.

When a traumatic incident occurs and a memory is created, the connections between the cognitive memory system and the emotion memory system can become dysfunctional. Under extreme stress the cognitive memory system becomes increasingly impaired, and the ability to organise and provide context begins to break down. Conversely, the emotion memory systems becomes increasingly activated (through increasing stimulation of the amygdala within the brain), which creates a substantial and intense emotional overlay to memories, but without the grounding of an appropriate context (from the cognitive memory system). The recall of these intense, often fragmented emotionally overladen memories can then be subsequently triggered (in effect rebuilt) in the absence of a factual cognitive basis, resulting in a critical stress reaction.

Federal Taskforce on Workplace Stress

"Stress is not the bad guy, a lack of ability and time to recover is the bad guy"

Dr Jim Loehr

Whilst in Colorado I was invited to attend and contribute to a meeting of the Federal Taskforce on Workplace Stress, chaired by the Deputy US Surgeon General, Admiral Zachary Taylor.

The key outcome of the meeting was the development of an outline for a future program for reducing stress within the Federal workforce. The key elements of the proposed program were to be based around:

- Introduction:
    - why stress is a problem – costs of stress in the workplace,
    - impact on elevating absenteeism,
    - impact on elevating presenteeism[5],
    - under appreciated costs of turnover.
- Providing an understanding of the nature of stress, including benefits and harmful effects;
- The nature of stressors, including the conduct of self-assessments to define exposure to stressors. Introducing the "24 hour how do you spend your day" survey tool;
- Understanding that many stressors cannot be controlled directly, therefore stress management is through how we respond to them;
- Role of leadership: including modelling positive behaviours;
- Employee self-measures – showing them what they can control themselves
- Toxic relationships: leadership's role in their management, techniques on their management;
- The development of a resource toolbox for staff and for their managers;
- Understanding how to manage stress recovery cycles;
- Guidance for managers on developing an action plan for how they will manage stress in the workplace;
- The hierarchy of coping skills for better stress management (Figure 2.4);
- Building personal resilience for all employees:
    - exercise,
    - healthy eating,
    - sleep habits,
    - relaxation,
    - healthy relationships, including recognising and managing 'emotional vampires''
    - mindfulness practices;
- Building organisational stress resilience - for managers;

[5] the concept of employees attending work whilst sick, or otherwise unproductive due to mental illness, stress, timewasting, etc. Recent research suggests that this could be costing an organisation more than absenteeism (APS, 2012; Hooper, 2010). A 2007 Medibank Private study indicated that presenteeism cost the Australian economy $25.7billion. Another study suggested that stress directly accounted for 13% of all presenteeism (Bonacum and Allan, 2007).

    - organisational recovery cycle,
    - coaching techniques,
    - dealing with acute traumatic stress,
    - management assistance and mentoring programs,
    - organisational indicators of concern (e.g. absenteeism, costs of lost work, stress levels, etc.);
- Hierarchy of coping skills derived from the military's mindfulness based mind fitness training;
- Concept of just culture vs blame culture;
- Stress recovery cycle;
- Organisational recovery cycle.

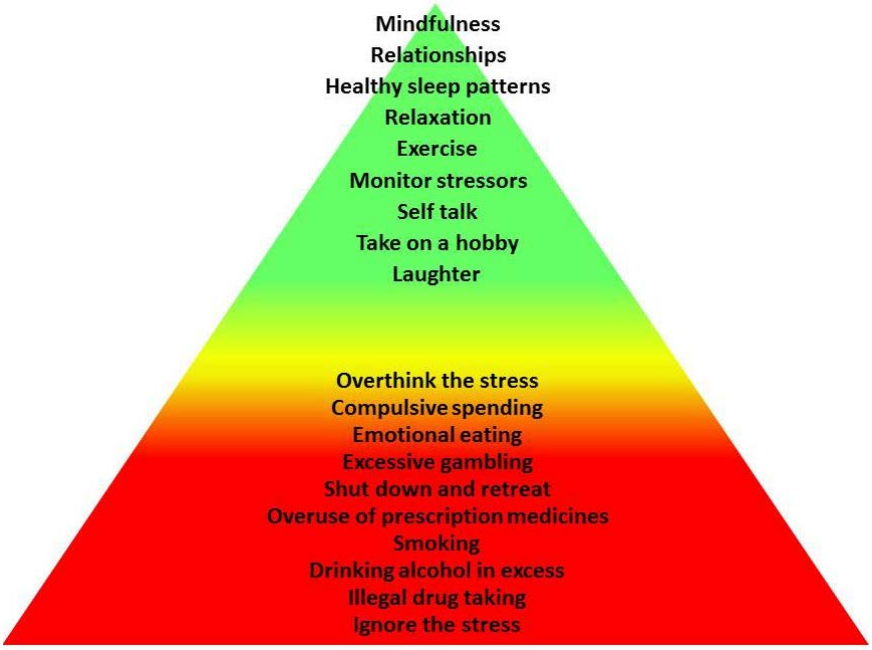


Figure 2.4: Hierarchy of Coping Skills

The Practice of Mindfulness

Mindfulness has been defined as the awareness of, and attention to external stimuli (such as sounds, sights, smells, etc) and states (change) and internal states (such as emotions and thoughts) (Dane, 2011). It is in particular characterised by attention in the *present moment*, i.e. avoiding preoccupation with thoughts of the past and of the future (Chaskalson, 2011; Weick and Putman, 2006). Mindfulness then is based upon the concepts that 'awareness' is the perception and experience of reality, whilst 'attention' directs awareness to specific items of the experience (Bishop et al., 2004). Mindfulness also embodies the concept of receptiveness, and is regarded as an inherent capability of humans (Kabat-Zinn, 2003). Mindfulness, however, is distinct from the concept of absorption, where in this latter state, there is a narrower spread of attention, and stimuli not related to the current activity are ignored (Rothbard, 2001).

Mindfulness, cultivated through forms of meditation, has been a central tenant of a number of Eastern traditions across many centuries, including Buddhism (Hahn, 1999), Islamic Sufism, Hinduism, Judaism and in some Christian traditions (reviewed in Rappaport, 2014). The application of mindfulness practices has been successfully secularised into a formal training program (Kabat-Zinn, 1990) which has been widely adopted by psychiatrists and psychologists worldwide as the Mindfulness Based Stress Reduction (MBSR) Program. Application of the MBSR has resulted in substantial improvements in learning, working memory, behavioural control, and improving coping with and recovery from stress, and from physical pain (Shepherd and Cardon, 2009; Brown, Ryan & Creswell, 2007; Shapiro et al, 2006 ;Grossman, et al., 2004; Segal, Williams, and Teasdale, 2002). The benefits of mindfulness have been demonstrated for improving task performance in dynamic task environments (reviewed in Dane, 2011).

There is considerable peer reviewed evidence demonstrating that attentional techniques improve performance in strategic decision making, risk awareness, observation of environmental stimuli, and resource utilisation (Nadkarni and Barr, 2008; Slagter et al, 2007; Bazerman and Watkins, 2004; Weick, 1993). There are also indications that mindfulness may improve attunement to intuition (Dane and Pratt, 2007).

Historically, mindfulness has become inextricably linked with meditative practices, however, the emergence of a psychological state of mindfulness does not require meditative practice (Brown and Ryan, 2003) and is attainable for those with an ability to focus and be attentive in the present moment (Giluk, 2009).

Introducing mindfulness into firefighting operations

Weick's work on High Reliability Organising introduced the importance of mindfulness in achieving high performance (Weick et al, 1999). Much of the training of federal firefighters has focused on developing mindfulness from the perspective of improved situational awareness. However, there has been some work on introducing more directed mindfulness capabilities through introducing meditative practices (James Saveland, personal communication). This has been approached through a number of techniques, including:

- Introducing yoga and/or meditation into formal morning (compulsory) physical training (PT) regimes;
- Developing mindfulness skills through a modified mindfulness based stress reduction (MBSR) course; and

Training in mindfulness as part of broader training in Margin of Manoeuver (MoM: see Chapter 5 for more detailed information).

Alissa Roeder, District Fire Mgt Officer / Div. 11, Morrison CO

US Federal firefighters are expected to maintain minimal fitness requirements depending upon the job type being undertaken (e.g. Hotshots, Smoke Jumpers, Engine Crews, etc). As part of maintaining physical fitness levels, most crews are afforded one hour for PT at the start of each shift.

A number of crews have been trained in and practice yoga and meditation techniques during these PT sessions. Understandably, there has been resistance in some crews to such practices.

One District (Officer in Charge Alissa Roeder) has resolved these issues by providing coaching in techniques from a former Special Forces operative. Demonstrating the use of mindfulness practices from elite military units has removed some of the stigma and reticence experienced in the 'macho' culture prevalent in the federal firefighting services. Discussions with the local commander (Alissa Roeder, personal communications) demonstrated a range of positive benefits arising from the mindfulness program including a calmer and more focussed approach from firefighters on the front line.

Based upon Jim Saveland's experiences (personal communication) there has been success in introducing simple breathing exercises that have a profound effect on reducing anxiety and improving mindfulness. This includes the traditional breathing meditation technique and the 4-7-8 breathing method developed by Dr Andrew Weil (see inset below).

4-7-8 breathing technique

This is based upon:

- Emptying the lungs of air,
- Taking a breath of air, via the nostrils, over a count of 4,
- Holding the breath for a count of 7,
- Exhaling through the mouth, with the tongue pressed the gum ridge behind the upper front teeth, for a count of 8,
- Repeating this for 4 breath cycles,
- After 1 to 2 months of practice this can be extended to 8 breath cycles.

The technique needs to be repeated on a regular basis -twice a day to achieve the benefits.

Immediate effects of the technique include a lowering of blood pressure and heart beat. Whilst these return to normal shortly afterwards, with continued practice, there is a measurable sustained reduction in blood pressure and heart rate, usually within 8 weeks of commencing the regular use of the technique. Under clinical conditions, the technique has been successful in treating previously intractable cases of anxiety and panic attacks. It is also successfully used in the treatment of insomnia.

The technique only takes a couple of minutes a day, with Saveland recommending its use for operational crews at morning briefings and at close of shift.

The benefit of this technique is that it can also be applied in any situation where the person is under adverse stress and needs to regain their composure and mindfulness.

On a personal note, after being taught the technique, I find that it can be applied quickly in many situations and brings rapid calming and increases focus.

Training in Mindfulness

Jim Saveland has also developed training for firefighters in more formal mindfulness techniques, based upon the MBSR (mindfulness based stress reduction) technique, originally pioneered by Jon Kabat-Zinn (Kabat-Zinn, 1990). This was originally developed to treat sufferers of stress and chronic pain, and has since been adopted by psychologists, psychiatrists, and medical general practitioners worldwide.

More generally, the techniques have been applied, to individuals and organisational workforces, with great success, with evidence demonstrated in multiple peer reviewed studies (reviewed in Chaskalson, 2011). The majority of these medical and more general applications of MBSR have been based upon an 8 week course, to train and practice the fundamental techniques. Such training has been associated with a range of benefits, including:

- Elevated personal resilience;
- Lowered psychological distress and stress reduction;
- Improved emotional intelligence;
- Heightened concentration and attention span;
- Heightened ability to retain and analyse information;
- Decreased impulsivity;
- Improved self-awareness and situational awareness; and
- Improved communication skills.

Structure of the Mindfulness Course

The standard mindfulness course (based upon MBSR), introduced to some firefighters and used as the foundation for Mindfulness-Based Mind Fitness as used by the US Marine Corps (see Chapter 4 below for further information).

This comprises an 8 week course, with one 2 hour session per week of formal instruction, and between 20 to 45 minutes of 'home based' practice daily.

First session: introduction

- Concepts of awareness and mindfulness;
- Role of emotion and cognition in awareness and decision making;
- The automatic reaction;
- Changing the nature of experience;
- Practicing mindfulness techniques:
    - 'Raisin' exercise
    - Mindful breathing technique
    - Body scan meditation

Second session: dealing with interruption, disruption and barriers

- Basis of perception and effects of bias;
- The nature of experience;
- Categorising of experience;
- Generation of emotion;
- The problems of misperception;
- Practicing mindfulness techniques:
    - Body scan meditation
    - Mindfulness of breathing meditation

Third session: mindfulness of experience

- Recognising the unfocussed mind;
- Maintaining a present moment awareness;
- Working in difficult and unpleasant situations;
- Deconstructing positive and negative experiences;
- Understanding habitual and automatic behaviours;
- Practicing mindfulness techniques:
    - Sitting meditation,
    - Mindful walking,
    - Simple yoga and stretching techniques.

Fourth session: Experience and attention

- Experience in attachment and aversion;
- Developing broad and focussed awareness;
- Understanding different perspectives;
- Recognising stress and stressful situations;
- Using breathing and mindfulness techniques in stressful situations;
- Practising mindfulness techniques:
    - Sitting meditation,
    - Breathing techniques.

Fifth session: understanding reacting vs responding

- The negative effect of experiences;
- Understanding the difference between reacting and responding;
- The role of reaction in stress;
- Understanding and being aware of our feelings and reactions;
- Acceptance and choice;
- Practising mindfulness techniques:
    - Sitting meditation,
    - Mindfulness of body and thoughts,
    - Dealing with reactions.

Session 6: developing 'reperceiving' skills

- Understanding the nature of thoughts;
- Understanding the condition of 'catastrophising' thought;
- Depersonalising issues;
- Dealing with harmful thoughts and emotions;
- Practising mindfulness techniques:
    - Sitting meditation practice,
    - Using breathing techniques to help focus on thoughts.

Session 7: taking care of oneself

- Self-awareness – recognising helpful, unhelpful and self-destructive behaviours;
- Identifying stress signatures;
- Developing strategies for managing stress and stressors -identifying helpful and unhelpful activities;
- Practising mindfulness techniques:
    - Longer sitting meditation,
    - Discovering stress signatures.

Session 8: changing behaviours

- Using mindfulness to improve satisfaction, wellbeing and performance;
- Maintaining momentum;
- Practising mindfulness techniques:
    - Conducting the body scan,
    - Breathing relaxation.

The key issues with the mindfulness training being provided to firefighters are:

- 8 weeks is a significant length of time and commitment for firefighters, (the commitment is 1 hour per week during work time, and 45 minutes practice at home each day);
- The mindfulness practice is relatively sedentary, and there is a belief that a more active approach to mindfulness would be beneficial;
- Because the training has its origins in eastern meditative practices, there can be initially some resistance arising from the 'macho' culture prevalent in many firefighting teams.

Future Development

During the study tour, work was commenced with Jim Saveland on developing alternate approaches to the current skills delivery arrangements. Unfortunately, this collaboration has halted for the time being because of the unexpected retirement of Jim Saveland.

Concepts under consideration included revising the format of the training, along the lines of one or more options:

- *Consolidated training package*
    - Replacing the dedicated extended weekly mindfulness course, into a more compact training workshop that could be delivered in a half day or one day training package. This would be similar in concept to the personal resilience workshop delivered by Dr Gibson in Toronto just prior to the commencement of the scholarship (see appendix B for workshop presentation),
    - Providing the mindfulness practice component as a single introductory session of techniques, with a voluntary take away practice package;

- *Online training package*
    - Developing the 'theoretical components' into an online resource,
    - Support theory with practice videos showing mindfulness techniques;

- *Integrative training*
    - Integrate short sessions on theory and practice into existing leadership, management, personal development and operational training courses;

- *Short frame training:*
    - Identify the shortest time requirement for training and practice that still yields measurable benefits. This was a key objective to the visit to Professor Amishi Jah's laboratory at the University of Miami (see Chapter 3 below).

Mindfulness as a Cognitive Skill

In gaining an understanding of how a situation is changing, and in effect changing an individual' or team's exposure to risk, the 'three bucket model' provides a simple scanning tool (Reason, 2008). This original concept can be adapted to fine tune mindfulness practice in an operational setting. This requires the user to focus on three aspects of their current experience:

- An examination of what is happening to 'self':
    - what is their level of experience, knowledge, understanding of the current situation?

- what is their level of mental and physical fatigue:
    - how long have they been working without a break?
    - are well hydrated are they?
    - how well matched is their physical fitness and health to the work requirements?
- what other stressors may be present, for example: team interrelationships, professional and personal life worries, etc?

- An examination of what is happening in the context of the situation:
    - how rapidly is the situation changing?
    - what levels of interference or disruption are being experienced?
    - are available resources adequate?
    - are significant time pressures present?

- An examination of the nature of the task:
    - are actions being undertaken near to the end of task or shift[6]?
    - do preceding steps provide cues for the following steps?
    - are tasks complex, unfamiliar, untried or being used in novel situations?

[6] Errors of omission increase in frequency in the tasks undertaken close to the end of a piece of work (Reason 2004).

Conclusion

Mindfulness practices have shown to provide tangible benefits in:

- Improving focus, attention, understanding and learning in a range of formal and informal training environments. A range of studies have also shown that quality, length and ease of retention is improved as a result of using mindfulness techniques;
- Improving situational awareness and sensemaking in strategic, operational and tactical contexts;
- Identifying and managing stressors and reducing the effect of harmful stress;
- Helping in the recovery from traumatic stressful situations.

For individuals not previously exposed to mindfulness practices there seems to be an inherent wariness of what are perceived to be 'off beat' ideas. However, many individuals that participate change their attitudes and gain benefits in a relatively short timeframe.

Although the original techniques upon which these practices are based usually require a prolonged commitment over an eight week period, benefits have been obtained form much lower time commitments (see Chapter 3). There are likely to be tangible benefits from introducing simpler versions of these practices into other training regimes.

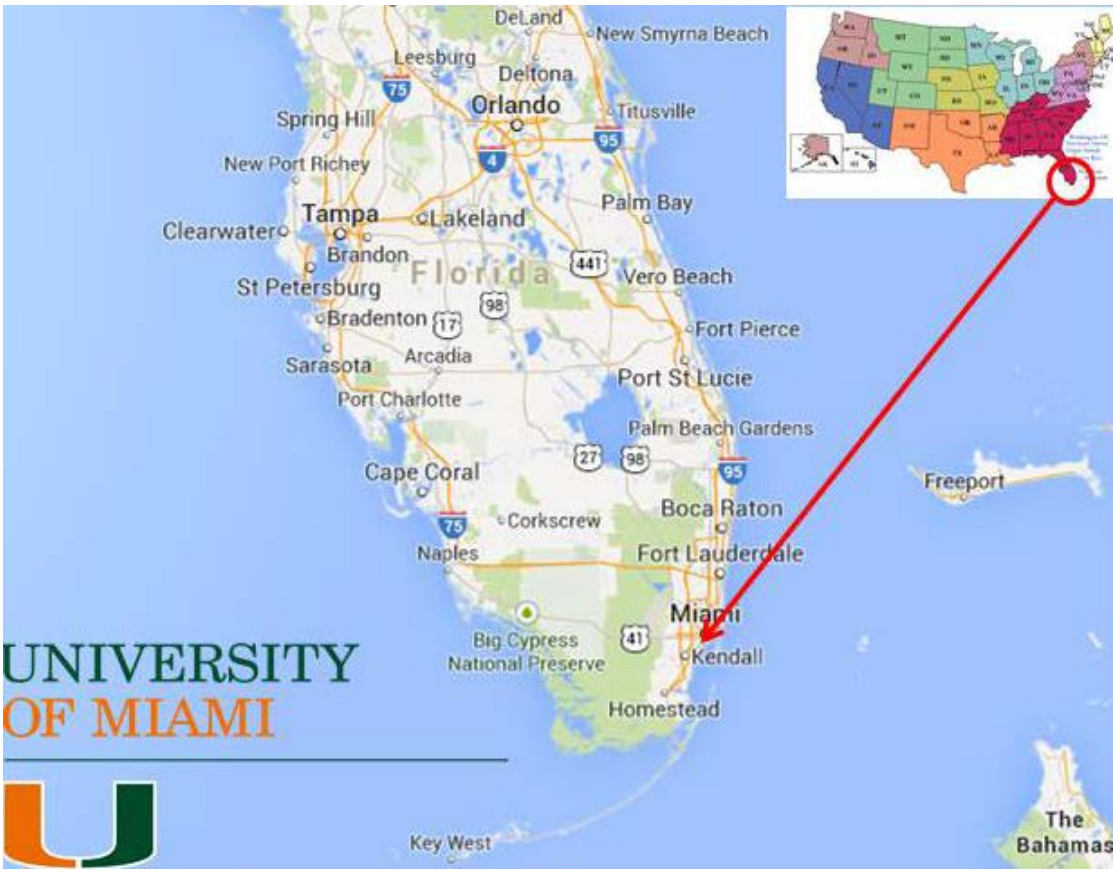
Certainly there are broad benefits to creating a better awareness of the origins and effect of stress on operational performance (and personal life) and providing training in developing strategies to identify and manage stressors.

Implications for the CFA and Other Emergency Services

There are two key themes that have direct and immediate relevance:

- The provision of training in the sources, role and better management of stress; and
- Incorporating simple mindfulness techniques into other appropriate existing training programs.

Chapter 3: The Neuroscience of Mindfulness



University of Miami

The purpose of visiting the University of Miami was to:

- Gain exposure to new research being undertaken on the neuroscience of mindfulness, identifying how the brain was affected by mindfulness and attention;
- Gain access to recent research findings into the effectiveness of mindfulness techniques in improving learning performance;
- Gain access to recent research findings into the effectiveness of mindfulness training in preparation of US Marines for combat deployment; and
- Examine the extension of mindfulness techniques into other disciplines.

Neuroscience of Mindfulness

Background to the Jah Lab

Professor Amishi Jah

The Jha Lab undertakes research into the stability and mutability of attention and working memory. The Lab is led by Amishi Jah (Associate Professor in Psychology) who has gained an international reputation for her work. The research conducted in the laboratory focuses on two key aspects of cognition, which interact to facilitate adaptive behaviour:

- ***Attention***, which allows for the identification of and sorting between relevant and irrelevant information;

- ***Working memory***, which maintains relevant information and allows it to be manipulated over periods of time.

The research work has a particular focus on how these two aspects can be altered through training, particularly through the application of mindfulness-based training techniques.

The Science of Mindfulness

Although founded in Eastern mysticism, mindfulness has several decades of robust clinical evidence that show a range of reproducible health benefits from its practice. This has been supported by substantial research demonstrating a range of cognitive and behavioural benefits arising from its use. Emerging research into neuroplasticity[7] is showing that training in mindfulness can induce measurable changes in brain structure and function. In effect, mindfulness training can positively rewire the brain. The practice of mindfulness, in particular, produces measurable changes in those parts of the brain essential for attention.

Mindfulness allows attention to be voluntarily and purposefully directed. Attention is the essential component of coordinating cognitive functions and regulating emotions. In stressful situations, attention can deteriorate with resulting emotional disturbances, cognitive dysfunction and impulsive reaction.

One effect may be that mindfulness reduces the ever present 'turmoil' present in the brain (the 'noise), improving the signal to noise ratio, and making the signal easier to detect and analyse. It is associated not just with purposeful attention, but also having some control of what and how we attribute meaning to our experiences (for example, the same event could be perceived as of little consequence, or conversely as highly harmful – the effect of catastrophising).

[7] Neuroplasticity, refers to the fairly recent discovery that the brain is capable of changing its structure with every activity undertaken. Furthermore, certain regions of the brain are capable of taking over the specialised functions of other parts of the brain, for example following a brain injury.

The concept of having a degree of 'control' over how meaning is attributed to events presents one explanation of why some individuals fall over in stressful situations, whilst others are largely unaffected.

Mindfulness research has direct relevance to engendering higher resilience in individuals. One of the known antagonists to personal resilience is the inability to manage negative emotions. The amygdalae (a pair of almond shaped parts of the mid-brain) play a major role in modulating emotions, particularly those associated with stress and anxiety. A common reaction to a stressful stimulus is that the emotional reaction 'perservates', (i.e. it continues after the stimulus has finished[8]), and continues well beyond the point where the emotion may have been of some initial benefit (for example, in evolutionary terms – such as the fear, flight, fight response). Over stimulation of the amygdalae in turn exacerbates the stress response, including the release of the chemical cortisol which further heightens stress driving an increasing spiral of activation.

Practising mindfulness has been shown to reduce the excitation of the amygdala, allowing it to recover to baseline much more rapidly. Mindfulness, by allowing a quicker recovery from stressful situations, looks to be an important contributor to improving personal resilience.

Mindfulness is not just about enhancing perception of our traditional five senses (sight, hearing, touch, smell, taste), but also other senses such as:

- Proprioception the phenomenon whereby we sense where our limbs are (based on stretch receptors in the muscles). This is a foundation of 'muscle memory', for example this allows us to drive – change gear and push pedals, without taking our eyes off the road; and

- Interoception whereby we are capable of sensing our internal physiological condition.

The benefits of mindfulness training have been demonstrated in a number of research studies looking into the coping and performance of individuals in laboratory and workplace settings (Baer et al, 2006; Jah et al, 2007; Chambers et al, 2008; Lutz et, 2010; Golding and Gross, 2010; Jah et al, 2010) . One study on teachers at work (Roeser et al, 2013) demonstrated that mindfulness training resulted in lowered psychological indicators of stress and burn-out, improved working memory capacity and focussed attention. Working memory capacity is important in controlling both emotions and cognitive demands.

Brain scans have identified a role for the prefrontal cortex in attention, regions of which become highly activated in mindfulness practitioners.

Emerging operational situations are by their very nature, highly complex with multiple dimensions. The common response to such situations is to focus on only a small set of those dimensions, often those that are first observed or recognised. Mindfulness opens up awareness to other dimensions present in the evolving situation, revealing a better understanding of what is occurring and an enhanced capability to analyse, develop and make decisions on a more comprehensive range of

[8] The amygdalae continue to be excited for prolonged periods after the original stimuli is no longer present.

options. Research over the last couple of years indicates that mindfulness training provides a protection against the effects of high stress events which would otherwise cause functional impairment.

Mindfulness in Operational Contexts

Professor Jah has also been undertaking research looking at the effect of pre-operational/combat mindfulness training (MT) on US marines, prior to deployment to Afghanistan (Jah, 2013 personal communication and Stanley et al, 2011). This training was based upon the traditional MBSR training, adapted to correlate it with operational scenarios, forming a new training approach – Mindfulness-based Mind Fitness Training (MMFT).

MMFT is based upon four core foundations, involving the development of enhanced competencies in:

i. ***Mental agility:*** encompassed in an ability to continue to think "*rapidly and creatively under stress*";

ii. ***Attention*****:** creating improved alertness and vigilance through an ability to focus on the task and filter out external and internal (e.g. emotions) distractions and reducing the chance of overreacting to situations;

iii. ***Emotional intelligence:*** including:

- the ability to recognise and understand one's own emotions,
- being able to affect practices to control emotions and their responses,
- ability to recognise and understand the emotions of others,
- using this understanding of self and other's emotion to improve interrelationships.

Increased emotional intelligence leads to both better situational awareness and to improved team cohesion and performance.

iv. ***Situational awareness:*** including:

a. awareness of the external environment,
b. awareness of the behaviour of others, and
c. also having awareness of the effect of external environment and other's behaviours on the one's own body's internal environment (e.g. fatigue, emotions, fight/flight response etc).

MMFT was provided to Marines as a two hour session once a week for eight weeks, with a day-long 'retreat' in week six. In addition to the 24 hours of formal instruction, participants were asked to undertake between 30 to 45 minutes home practice each day, supported by instructional CDs.

MMFT covered much the same ground on mindfulness as the more traditional MBSR, but in addition included more operationally relevant content. This included sections providing case study material from counterinsurgency operations and instruction on stress resilience. The stress resilience training featured:

- ***Stress inoculation***: involved introducing marines to the types of stressors they would be exposed to on operation in order to increase their familiarity and predictability and provide some exposure to approaches to control them;

- ***Somatic experiencing***: which considers the physical effects on the body of the "fight, flight, freeze or collapse" reaction to a stressful situation, and how individuals can be caught up in one of these reactions and continue to exhibit the behaviour/symptoms long after a traumatic incident has passed. Techniques can then be applied to allow an individual to recognise this reaction and provide strategies for lessening their effect.

- ***Sensorimotor regulation***: in which the participant is trained to be attentive to and cognitive of what their body is experiencing through the interaction of emotions, physical and physiological sensations; their effect on perceptions; these influences on thoughts; and the emergence of impulses.

- ***Trauma resilience model***: which builds upon the above two somatic approaches (issues with the mind expressed as physical and physiological indicators), by considering the effect on the autonomic nervous system (ANS) and its expression physically as changes in: breathing, muscle tension, discomfort, small bodily movement, tremors, temperature sensations, constriction, relaxation and pain.

The MMFT was shown to enhance learning and recall of other types of training undertaken in the same time frame, improve combat performance, improve situational awareness, reduction in role stress, shorten recovery time from stressful events and reduce the incidence of post-traumatic stress disorder. Mindfulness practice provides individuals with a resource that helps strengthen a range of factors crucial to personal resilience, including: regulation of emotion, cognitive flexibility, willingness to reappraise the situation and willingness to face personal fears.

Professor Jah recognised that the current dogma on which MMFT was based required a significant daily time commitment from troops participating in the program. Her subsequent studies have focused on attempts to identify the minimum mindfulness practice time that can be engaged in and still produce beneficial effects. Her work has shown that practice can be reduced to as little as 12 minutes per day and still be effective for attention and working memory. If individuals did not maintain this regimen, their performance did degrade over time.

From a practical perspective, such mindfulness training allows individuals to hold pertinent information in their minds, recall it when required and without distortion. This recalled information

is then available to guide behaviour in stressful situations, without the mind resorting to a purely reactive mode, which can often be inappropriate or even harmful in those circumstances.

"Normal thinking" patterns, which can in fact generate quiet abnormal thoughts and misperceptions about reality, are associated with a network of brain activity located in the midline of the cerebral cortex. This 'default network' helps to create narratives about what we experience, such narratives often representing a very biased perception of what we actually experience. This area of activity is also closely associated with so called mind wandering or inattention. After the 8 week period of mindfulness training, default network activity lessens and more lateral brain activity increases, the 'experiential network', which is associated with self-referencing, rather than getting lost in self-narrative.

Thus, with different patterns of brain activation emerging, individuals practicing mindfulness become more able to objectively assess their experiences rather than taking them personally. This does not remove the story we create about ourselves (our self-narratives), but provides us with an additional perspective with which to view events, for example, lessening the potential for self-blame arising out of a 'bad experience' by providing us with multiple dimensions of reference.

By reducing the amount and strength of things that individuals take personally, a significant amount of distraction (thus improving attention) and stress is removed from their lives.

Mindfulness in the Justice System

Meeting with Professor Scott Rogers, School of Law Miami University

Professor Scott Rogers teaching mindfulness practices

Background to Mindfulness and Law

Professor Rogers is a senior lecturer at Miami Law who researches into and teaches the practice of mindfulness. He had founded and is the current director of the Institute for Mindfulness Studies and leads the University of Miami School of Law's Mindfulness in Law Program. Since 2007 he has been training judges and attorneys in the practice of mindfulness and is the founder of the Mindfulness in Law Joint Taskforce of the Dade County Bar Association and the Federal Bar Association. The programs that have been run by Professor Rogers have produced health and wellbeing improvements in both professional and personal lives of legal professionals.

Miami Law offers a formal graded module on mindfulness as part of its curriculum for law students. The module is based around the following one hour weekly classes:

- *Class One: Introduction to Mindfulness and Class Objectives;*
- *Class Two: The Art and Science of Mindfulness;*
- *Class Three: Mindfulness in Law;*
- *Class Four: Mindfulness, Mediation and Negotiation;*
- *Class Five: Mindfulness, Ethics, and Relationships;*
- *Class Six: Mindfulness Immersion;*
- *Class Seven: Mindfulness, Non-Judgmental Awareness and Judicial Decision Making (with a visiting Judge);*
- *Class Eight: Mindfulness and the Parallels Between Mountain Climbing and Trial Practice;*
- *Class Nine: Lawyer as Artist: Cultivating Creativity Amid the Chaos;*
- *Class Ten: Emotional Intelligence and a Cognitive Oriented Approach to Mindfulness*

The belief is the course engenders not only better academic performance throughout the students remaining studies, but also creates more rounded and capable graduates.

Miami Law also offer a short graded course in mindfulness in leadership, the curriculum being based on extensive out of class reading (see Appendix C for reading lists) and 5 x 1hr 40 minutes classes

Class 1: The Art, Science & Practice of Mindfulness, and its Connection to Leadership;
Class 2: Leadership Principles, You, and the Essence of Mindful Leadership;
Class 3: Mindful Leadership Immersion (Class 3 is a full day class);
Class 4: Putting It All Together;
Class 5: Final Class.

From a research perspective, Professors Rogers and Jah have collaborated to look at the effect of short-form mindfulness training on the academic performance of university students. Training was provided for 1 hour a week over seven weeks. Students undertaking the training performed at a higher level on SART performance tests (Sustained Attention to Response Test), recorded higher task accuracy, and self-reported as being more "on-task" than untrained control participants. The conclusion being that mindfulness training helped to curb mind wandering.

Conclusion: Bringing the science and practice of mindfulness together

There exists a substantial body of peer reviewed research that demonstrates the clinical, psychological and behavioural benefits of the practices of mindfulness techniques. Early studies, both laboratory and field, focussed on experienced practitioners of mindfulness, for example using meditation techniques.

More recent work has secularised the practice of mindfulness and has shown that individuals can be trained in these techniques over a short instructional period. When such instruction is combined with teaching on how the mind and body react to stress, and are shown the science of mind-body interaction, their acceptance of the instruction is increased, this accompanies a more sustained commitment to practice.

Firefighters faced with large, complex, fast moving wildfires can experience a range of cognitive, emotional and psychological challenges, which can impair their awareness, understanding and decision making at time of high stress. Mindfulness training does provide individuals with an increased capacity to manage such challenges, and provides skills that directly affect areas of potential dysfunction (see figures 3.1, 3.2 and 3.3 below).

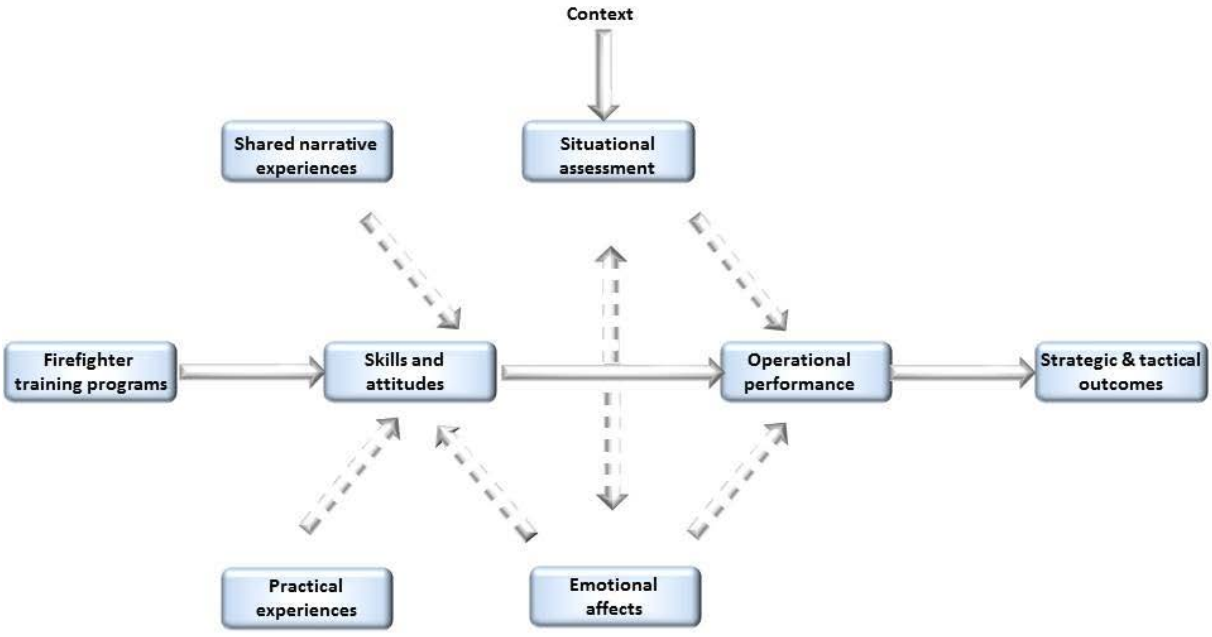


Figure 3.1: Capability and outcome model

Figure 3.1 presents the basic capability and outcome model (Gibson, paper in development). This is a simple model showing *representative* influences on organisational performance. The basis of the model is that training programs are designed and delivered with the intent of developing a range of

desired skills in participant firefighters. The content (both formal and informal) along with the means of delivery will establish not just the desired competencies, but also individual sets of attitudes, which in turn will also influence how these competencies are used. These skills and attitudes are also influenced by the practical experiences (both within and outside of service) that firefighters are exposed to, and by the shared experiences and beliefs of peers and supervisors (in the formed of shared narratives). The accretion of these skills and attitudes is further influenced by a complex emotional overlay that may either enhance or detract from the learning experience.

In turn these skills and attitudes will be a major driver of operational performance, influenced by the context (including the operational context – the nature of the conditions being faced; and by the internal context, the nature of the organisational factors influencing individual firefighters). As well as direct effects on performance, there will be a further influence on how each individual perceives the context for example through differing effectiveness of situational assessment. Again emotions will affect both how the situation is perceived and how the interplay of skills and attitudes are deployed. This mechanism plays out at individual and team levels to determine to what extent strategic and tactical outcomes are realised.

There are a variety of factors that act as barriers to the smooth progression across this model (Figure 3.2) and have a negative influence on the achievement of strategic and tactical outcomes.

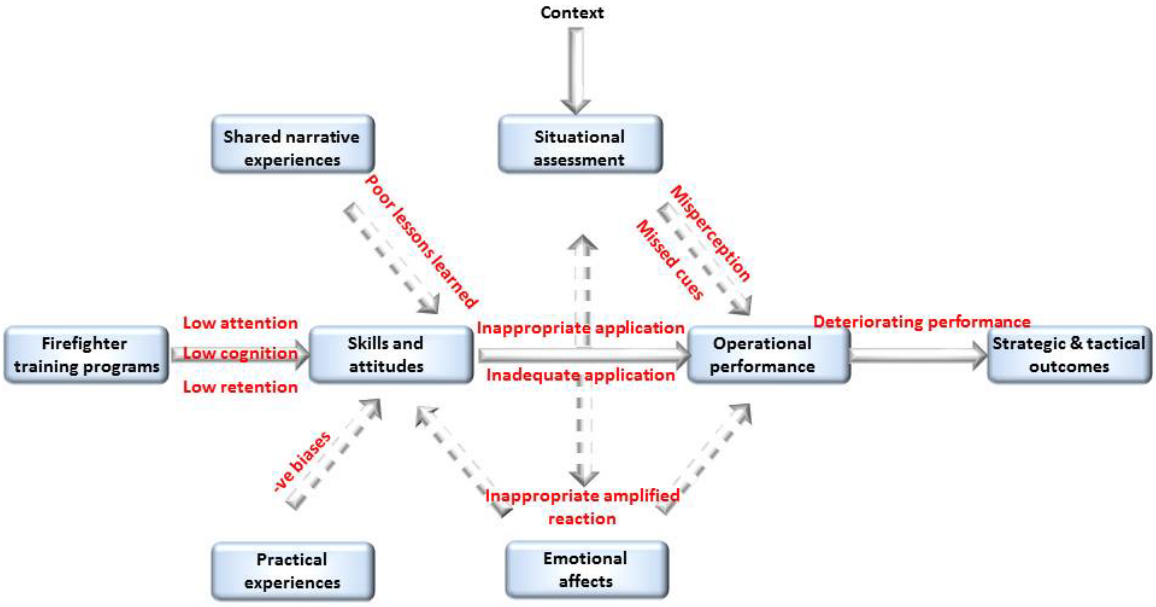


Figure 3.2: Barriers to the achievement of strategic and tactical outcomes

For example, new skills development can be adversely affected by:

- Impaired attention (for example, due to fatigue, distraction, mind wandering, etc) resulting in poor focus;

- Poor cognition (including fatigue, mood disorders, sleep disturbance, absence of learning skills, motivational limitations, mental representations of tasks);

- Low retention and recall, for example, due to:
    - impaired attention,
    - lowered motivation,
    - the stability of recency,
    - interference during recall, (the effectiveness of the transition of experiences from short term to long term memory).
    - exposure to, and dependency on harmful contexts,
    - lack of rehearsal of learning,
    - poor physical fitness and inappropriate lifestyle.

Prior related personal experience can introduce negative bias to both the learning experience (for example reducing motivation) and to the perception and understanding of the subject matter being learned. Similarly, a great deal of understanding and assimilation is influenced by shared sensemaking with others, usually in the form of communicated narratives about these and similar experiences. Such shared sensemaking in a poor learning environment can then result in lessons learned being degraded.

Part of the way that memory works relies on the amygdala encoding an emotional overlay with every memory that is created. Therefore during the learning, emotions have a strong role in amplifying the adverse effects of each of the different types of learning barriers (as above). An adverse emotional state will therefore be deleterious to effective memory formation and the subsequent ease, accuracy and applicability of recall. The ability to recall and utilise skills in an operational setting is therefore highly dependent upon the environment as well as the physical, mental and emotional state of an individual whilst the learning occurs. A solid learning foundation, with strengthening of memory through repeated rehearsal will improve the chances of appropriate deployment of those skills subsequently. Particularly where the operational circumstance may be highly complex, volatile and stressful, when inappropriate recall and use of those skills may be especially impaired.

The nature of the event, and the acuity of an individual in assessing the situation will have a strong bearing on how skills are recalled and put into practice. Cues may be missed, ignored or disregarded, or may overwhelm the individual. Situational assessment may be ‘off the mark’ with significant misperception occurring with a resulting misapplication of skills. Again an individual’s emotional state, during an event, will have a substantial amplifying effect on barriers that can impair operational performance.

The combination of these factors working either synergistically and antagonistically will degrade operational performance. In some circumstances, individuals may appear to have gained high levels of expertise, however, when stress is applied to their recall and analytical capabilities, a sudden and dramatic degradation in capability can manifest.

The application of mindfulness practices can have a substantial effect on both enhancing the null state and in removing or lessening the effect of these barriers on learning and performance outcomes (Figure 3.3).

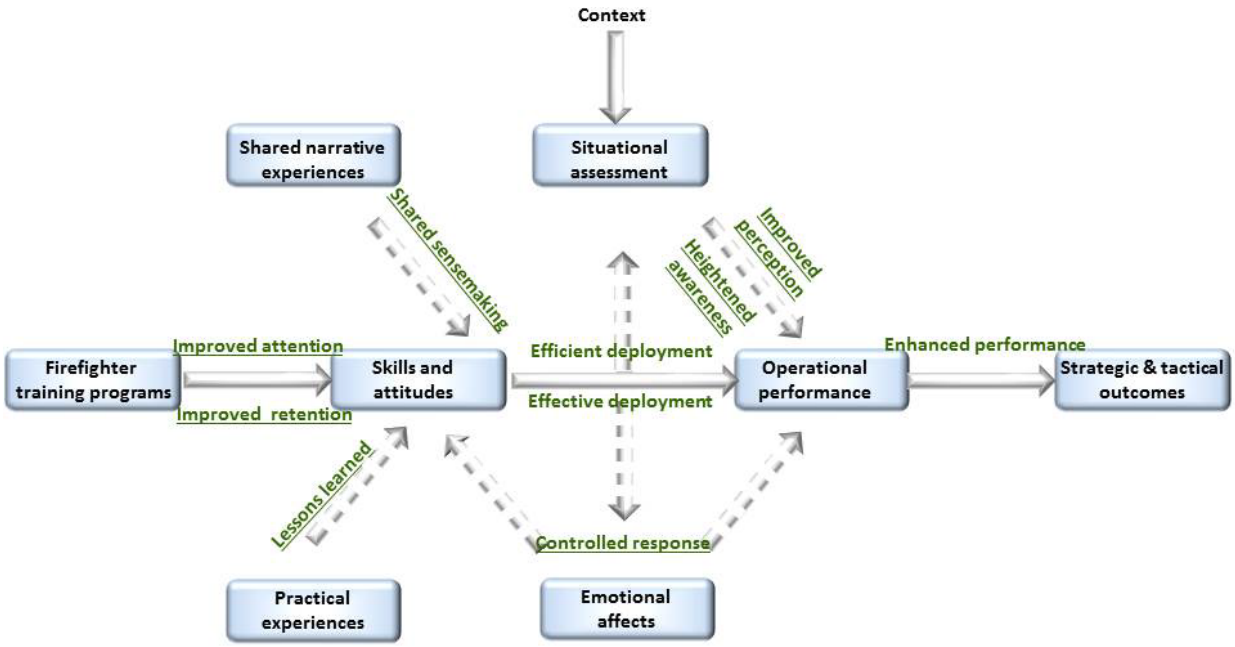


Figure 3.3: Effect of mindfulness practice on improving strategic and tactical outcomes

Mindfulness practice and more specifically mindfulness training (for example MMFT or MBSR) has been show in numerous studies to improve mental functioning with respect to:

- Improving attention and retention during training;
- Positively affecting attitude and motivation during formal and informal learning experiences;
- Improving the encoding of learning from practical experiences;
- Improving capacity for personal and shared sensemaking of routine and abnormal situations;
- Providing an enhanced awareness of self and facilitating improved control over emotions and the their effects, particularly in regards to sensemaking and in transition from reaction (uncontrolled) to response (controlled) to complex situations;
- Improving the breadth and focus of attention in novel situations, inducing more conscious regard of perceptions and thereby enhancing situational assessment;

All of which contributes towards creating a more sustainably improved performance.

Implications for CFA and other Emergency Services

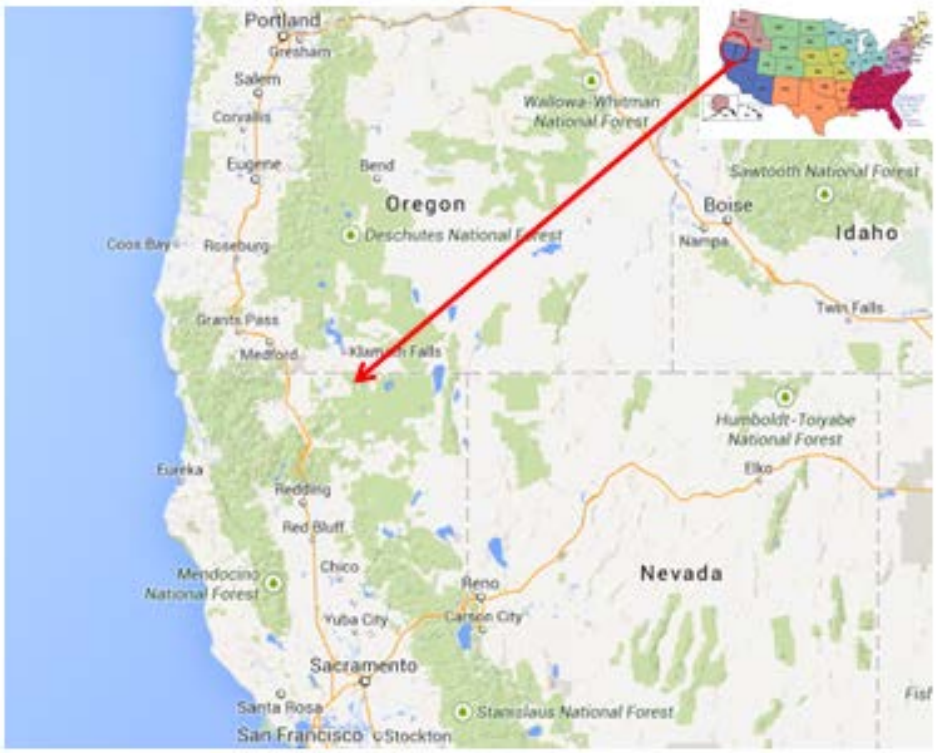
The work undertaken at the University of Miami clearly shows that there is a strong scientific basis to the practice of mindfulness and that can have a measurable effect on capability and performance.

During the visit I was able to facilitate the introduction of Captain John Crawford (Miami Fire and Rescue) to Jah and participate in discussions regarding the establishment of future research collaboration. Discussions centred around a potential pilot (subject to funding) involving training, psychological testing and fMRI scanning of Miami firefighters undertaking a two weeks captains course. This was with a view to a possible extension to seeking funding and establishing a research study involving CFA volunteer recruits undertaking training.

Irrespective of any future research studies, the science clearly shows that there are a range of tangible benefits from receiving training such as MMFIT for emergency services personnel.

Such training could be provided via a combination of direct face to face and online experiences.

Chapter 4: Field training, Observation and Participation



Lava Beds InterAgency Operations Centre, Modoc, Northern California

The purpose of the visit to the Lava Beds Interagency Operations was to observe the application of high reliability organising and mindfulness practices to local firefighter training, ground operations and fire response.

Field Training in HRO and Mindfulness

The Lava Beds Interagency Operations Centre is home to the US Forest Service (USFS) - Engine 64 and US National Parks (USNPS) Engine 74 units. Commander of Engine 64 is Captain Ben Iverson (recently appointed as Training Specialist to the Primary Leader Academy, Pacific Southwest Fire and Aviation Management at Sacramento). Captain Iverson had recently completed a twelve month secondment to the National Lessons Learned Centre, which included the continued development of field practices for high reliability organizing (HRO) and mindfulness.

The visit to the Interagency Operations Center enabled participation in classroom and field training for front line responders in these practices. This included participation in refresher training on performance and mindfulness (course presentation at Appendix D) conducted by Captain Iverson and attended by Forestry Service, Parks Service, Bureau of Land Management and Fisheries and Wildlife firefighters.

Captain Ben Iverson, Engine 64

The training course's goals were to improve operational safety and operational performance. The course was built around the concept of *comprehensive fitness* through the integration of 'health' – 'safety' and 'performance'. This work has been largely influenced by the concepts of the 'Corporate Athlete' and the US military's Comprehensive Soldier Fitness programs.

The 'Corporate Athlete'

The basis of the Corporate Athlete program is to create sustained performance in the face of dynamic change and continuing pressure. The concept recognizes that there is a dynamic between stress (as energy expenditure) and recovery (as energy renewal), with a continual oscillation occurring between the two. Some level of stress is required for normal healthy change and growth. However, if there is inadequate recovery from stress it will have a major adverse impact on sustained performance, leading to eventual burnout.

This corporate athlete concept posits that the traditional approaches to high performance (management by objectives, financial rewards[9], establishing a performance culture, etc.) represent only part of the solution, focusing as they do only on cognitive relationships. The corporate athlete approach brings into focus the cognitive elements alongside the role that other equally important factors play (Figure 4.1), in effect building supporting capabilities around:

- ***Body:*** building physical capacity for endurance, achieved through a combination of healthier eating, better sleep patterns and building exercise into the daily work routine (wildland fire fighters in the Modoc started each day with an hour's self-directed PT). Work by chronobiologists has shown that to maintain performance, we need to be aware of the biological rhythms that our bodies are subjected to, the effects that they have, and strategies for managing them. These rhythms are controlled by the hypothalamus within the brain, forming a biological clock. If the effects of these rhythms are ignored they can cause a number of performance problems (reviewed in Hedge, 2013) including, for example:

    - '***Post lunch dip***' effect: generally occurs between 1pm and 4pm, even if lunch has been eaten or not (but the effect is amplified by a heavy lunch) and is associated with a deterioration in work performance. The main symptom is one of decreased alertness, and is for example *a period with a significantly increased likelihood of motor vehicle accidents*. This can be combatted, *in the short term*, with drinks such as coffee, tea or fruit juice, power nap, or moderate physical exercise. However, there is no real substitute for quality sleep.
    - ***Time of day errors***:
        - *just before dawn:* period of highest risk for single motor vehicle accidents'

[9] In fact research shows that above a certain level, increasing financial rewards actually degrades desired behaviour and adversely affects performance (reviewed in Pink, 2009).

- the middle of the night: period when many major catastrophes caused by 'human error' occur,
- visual search speed is lower in the evening compared with the morning
- cognitive performance is higher around lunchtime, compared with evenings and mornings.

- ***Mind:*** the cognitive element which provides the mental capacity to perform. This has been the traditional target of improvement programs such as 'process reengineering' and 'change management'. More recently there has been growing recognition of the benefits of attentional focus techniques such as meditation, mindfulness practices, etc. These techniques affect 'mind' by reducing mental turmoil, improving attention, improving emotional control, reducing distraction, and providing positive effects on 'body' through a range of physiological effects, fatigue reduction, improved sleep patterns etc.

- ***Emotion:*** recognizing the role that emotions play in influencing both cognitive and physical processes, particularly in that 'positive emotions' increase energy and drive higher performance, whilst 'negative emotions' deplete energy, increase blood pressure, heart rate and muscle tension, and lower performance. The key competency in this respect is learning to recognise adverse emotions as they begin to arise and having a tool box of strategies ready to respond.

- **'Spiritual' fitness:** The use of the word 'spiritual' does create some initial barriers to acceptance because of the misperception of it being about 'New Age hippies' or 'religious zealotry'. The term 'spiritual' is better interpreted in the concepts of recognising and accessing a deeper sense of purpose and values, where these assist in guiding focus, provide a corner stone for resisting adversity, increasing motivation and enhancing personal resilience. There is a wealth of research that shows significantly enhanced resilience for those that possess a strong spiritual foundation. The spiritual element can often be manifest as strong commitment to the service of others, a common value of emergency services personnel.

The corporate athlete proposes a holistic integrated model that brings these elements together all contributing to performance.

A high level of performance, can be achieved (usually for short periods of time) when one or more of these elements are diminished or absent. However, an individual is unlikely to achieve their optimum and sustained performance without all elements present and integrated. Research into both high performing athletes and senior executives has identified an ideal performance state (Loehr and Schwartz, 2001), at which optimum capacity is reached in attentional focus, self-control, flexibility, endurance and strength.

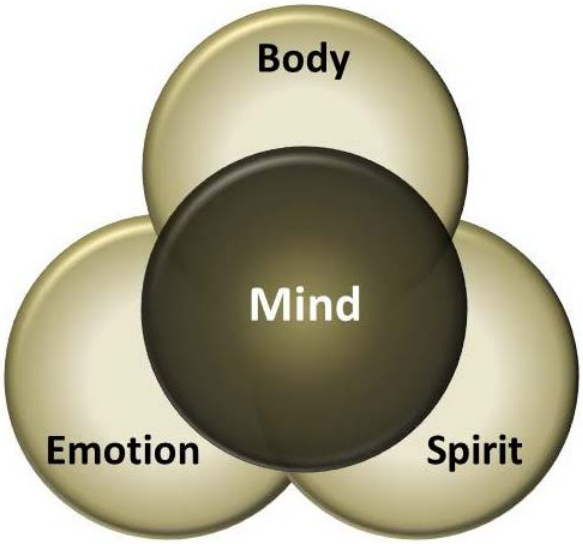


Figure 4.1: the key elements of Corporate Athlete

Comprehensive Solider Fitness Program

A similar approach to the Corporate Athlete has been developed by the US military: Comprehensive Soldier Fitness Program (CSFP), which again is based around the development of mind, body, spirit and emotion, with an emphasis on the role of social and family interaction and support (see Figure 4.2). A key component of the Program is the Master Resilience Training (MRT), which is conducted as a train the trainer course. The MRT comprises the development of six core competencies (see Appendix E for curriculum summary):

- Self-awareness;
- Self-regulation;
- Optimism;
- Mental agility;
- Strengths of character; and
- Connection.

Figure 4.2 Comprehensive Soldier Program

Longitudinal studies on over 22,000 troops undergoing operational deployment into combat zones has demonstrated that participation in the CSFP is strongly correlated with significantly improved personal resilience and psychological health.

Training of operational firefighters

Engine 64 (Forests) and Engine 74 (Parks) crews attending training (Carl Gibson centre)

The training module is part of ongoing training provided to local Federal firefighters in the Lava Beds and Modoc areas of Northern California. Whilst the training is primarily aimed at the two Forests/Parks agencies, attendance is also offered to the neighbouring Wildlife, Game and Fisheries; Bureau of Land Management; and Bureau of Indian Affairs firefighters.

The intent of the training is to reinforce HRO practice by introducing concepts from other programs (such as Corporate Athlete, Comprehensive Soldier Fitness, mindfulness, neuroscience, etc). The aim of this training is to substantially improve safety and operational performance by helping firefighters to observe and think in significantly different ways compared with traditional approaches.

"Attaining Performance through Comprehensive Fitness:

Health-Safety-Performance"

The training was provided in a class room format over a ½ day period and comprised:

Part 1

i) Introduction:
- Overview of previous events that created performance and safety issues for firefighters;
- Using an elite athlete as a model of high performance;
- Physical and psychological aspects.

ii) Overview of corporate athlete program:
- Establishing trigger points;
- Concept of 'full engagement": 'physically'-'energised'; 'emotionally' – 'connected'; 'mentally'-'focussed'; 'spiritually' – 'aligned'.

iii) Concept of insight.

iv) Risk behaviours:
- Road safety case study – approaching safety in a different manner;

v) Complexity and adaptation concepts:
- Forest fire evacuation exercise.

vi) Mind and brain – looking at how we think
- Attention and observation exercise;
- Case study on misperception – Modoc helicopter rappelling fatality.

Part 2: Taking action

vii) Mental fitness:

- Understanding motivation;
- Developing an aligned mindset;
- Focus and awareness;
- Techniques for mastering awareness.

viii) Physical fitness:

- Physical training;
- Eating habits and diet;
- Finding balance.

ix) Mastering the firefighting craft – continuous learning and new thinking:

- Case study – Air Force One;
- Case study – falling accident;
- Case study – changing behaviours – The Fun Theory;
- Autonomy exercise – improving crew performance;
- Understanding and creating acceptable risk.

Practice in the field

Lava Beds National Monument

The study provided the opportunity to observe and have discussions with fulltime and seasonally employed 'Forests' firefighters undertaking both vegetation management and deployment for asset protection in response to a local wildfire.

Regular toolbox meetings to ensure goal alignment and capture learnings

Personal Observations

I made the following observations:

- Unit leadership was clearly committed to enhancing safety and performance of crew members. This was evidenced by:
  - The unit Captain leading the development and delivery of new training approaches with the aim of not just imparting knowledge, but also of challenging crews perceptions, biases and ways of thinking;
  - Encouraging crews from other organisations (that they may have to work with on operations) to participate in this training;
  - Capturing learnings from a wide range of fireground accidents from other units to improve the crews understanding of risk and its amplification;
  - Using routine work operations, such as tree felling, fuel clearance, etc. as learning opportunities;
  - Conducting regular 'tool box' discussions through the day to check on clarity of objects, identify issues arising and make adaptations as required;
  - Providing opportunities for leadership to develop, by encouraging other crew members to lead training opportunities;
  - Cultivating crews confidence in speaking up about concerns and by 'deferring to expertise' within the crew when the occasion required it.

- In day to day activities all personnel clearly demonstrated a commitment to improving their performance by actively participating in training opportunities. Crew members clearly showed that they were enthusiastic about learning new things away from the traditional firefighting competencies.

- The Engine 64 crew did make mistakes on the ground, but worked as a team to identify problems. For example in a long distance hose lay, seasonal staff were guided by more experienced crew to identify problems, think through how their actions could create increased risks downstream and worked out options for reducing their risks. Leadership was clearly allowed to emerge from within the crew to solve problems as they arose.

- This emergent leadership allowed the formal crew leadership to look to the bigger picture of what was happening and not be distracted by minor issues that were well within the capability of the crew to resolve.

- Several crew members did express some conceptual difficulties, particularly with the concept of dynamic risk assessment, they believed that:
  - The dynamic risk assessment process was not intuitive;
  - Such assessments on the fireground required significant effort;
  - Often conflicted with their intuition or rapidly formed professional judgements;
  - During busy periods, they had insufficient time and focus to meet the demands that such an assessment required;

- The assessment process worked well in relatively calm and stable situations, but became less effective as conditions became more ‘chaotic’;
- Consequently, firefighters, including crew leadership often abandoned the assessment and relied on ‘feel’;
- The Captain had begun to expose them to some very early developed concepts of Margin of Manoeuver and felt that this provided a more practical and intuitive way of looking at situations. It was apparent that although potentially beneficial, this concept needed significantly more development to make it a robust tool on the fireground.

- Crews understood concepts underlying integrated approaches to developing mind and body. However, there was some minor unease with use of the term ‘spiritual’ and it appeared that their ideas in this area were better being expressed as ‘cultural’ and ‘relational’.

- One of the major issues was with regards to high reliability organising (HRO). Whilst crews understood the theory and were trying to put in place practices, these were often individual changes made with respect to individual HRO principles, rather than an integrated improvement approach. The key criticism, raised by individual crew members, lay in the lack of guidance in practical implementation of these concepts. Several crew members did indicate that they only really began to understand the HRO principles when they were shown their application on the job.

Continuing focus on balancing operational performance with changing risk

Conclusion

Integrated approaches based on 'Corporate Athlete' and 'Comprehensive Soldier Fitness' appear to be achieving success on a local basis. Part of the success of this is down to the enthusiasm of the leadership team in driving novel training programs.

Providing instruction in how the mind and brain function and how this affects the body, emotions and response to stimuli has helped crews to better understand how they behave in certain circumstances and better adapt to challenges.

Most of the crew members involved had not participated in lengthy intensive formal and centrally run training on these topics. Their entire exposure has been through local unit leadership, and provided either as part of skills maintenance, team building or short training sessions.

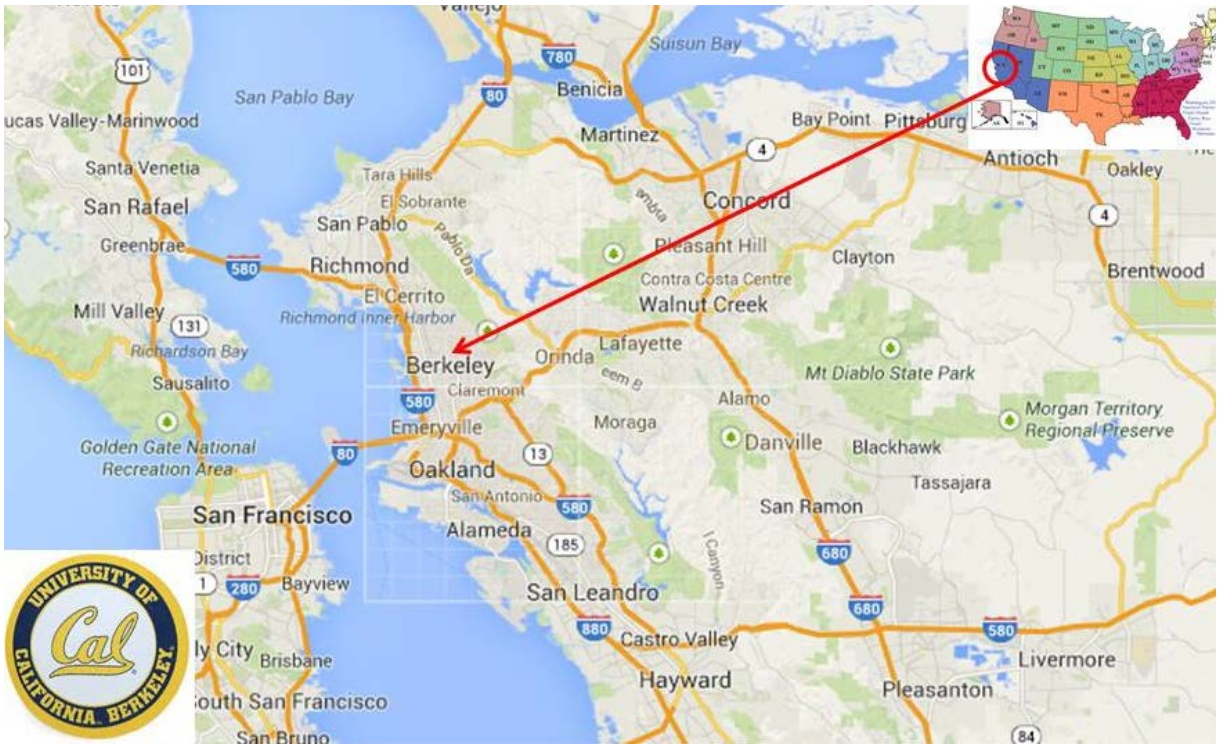
As a result of discussions with multiple personnel and through observation, it was apparent that the crew did demonstrate an application of HRO principles, showed improved mindfulness, particularly with respect to situational awareness. Collectively they were willing to share experience in a non-critical manner, and less experienced crew appreciated the learning opportunities that this behaviour created. Individually all crew members showed task focus, but also demonstrated a high awareness for their own safety and for their fellow crew.

Application to the CFA and Other Emergency Services

It was apparent that the provision of short form training by local officers did have a noticeable effect on firefighter understanding of concepts and their application on the ground in both routine and fire ground response. It also demonstrated the value of leaders themselves applying these principles and practices in their development and management of their crews. It also demonstrated the practicality of creating a train-the-local trainer approach in effectively deploying this learning to local fire fighters at a unit or Brigade level.

The training materials taught to multi-agencies attending the local training at the Interagency Operations Center (Appendix D) can be readily modified to provide a simple short training tool for improving performance, situational awareness and safety for Victorian agencies.

Chapter 5: Towards developing an alternate approach for considering and managing risk



Novel approaches to the management of risk

The following section is based upon novel research undertaken by Dr Carl Gibson and Ivan Pupulidy (Director, of the Office of Learning, USFS), initiated in San Francisco and at University of California Berkeley (in discussion with Professor Karlene Roberts, Emeritus Professor) and continued as privately funded research after the end of the scholarship period.

Ivan Pupulidy

Volatile situations – a fault of the mind or a failure of risk management?

We are all familiar with the simple problem that we start to tackle, which then rapidly changes into a complex, volatile crisis situation that is characterised by uncertainty and a propensity to overwhelm us. The more novel a situation is, the more uncertainty we will face in trying to understand and deal with it. However, such circumstances can be highly deceptive, and for some time the apparent familiarity of the situation lulls us into a false state of certainty and understanding.

Then, seemingly out of nowhere, everything changes, what was a simple and routine environment no longer is. There are generally three responses to events of this nature:

- We ignore the information that a significant change is occurring and carry on regardless;

- We recognise that change is occurring change and try to respond, but (physically, cognitively or emotionally) cannot cope with it; or
- We recognise the change and continue to adapt as the context continues to evolve.

Unsurprisingly it is the functioning of the mind that ultimately determines which of these courses of action we take. The mind being influenced by the functioning of the brain, feedback from the body (senses) and the interaction of relationships (Figure 5.1).

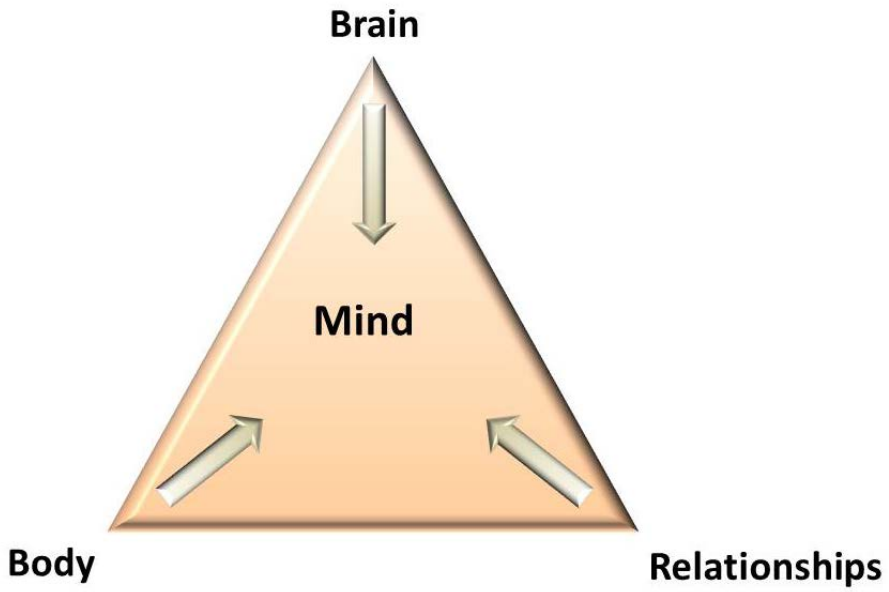


Figure 5.1 Creation of the mind

The mind creates its own 'reality'. For the majority of the time, this 'reality' will resemble the 'reality' created by other minds with access to the same range of information. In a routine environment, these perceptions of reality will be nuanced by individuals' level of knowledge, past experiences (memory), physical and emotional states, and how they interrelate with others. As the context becomes increasingly non-routine the effect of these factors can amplify differences in perception. This can occur to the extent that one or more individuals will be experiencing a 'reality' that is very aberrant from a more rational experience.

When risk is being examined using any of the traditional approaches, it will be highly subject to differences in perception, which can result in substantially different viewpoints in the degrees of risk exposure that exists. In a rapidly changing environment, these differences in risk perception can result in inappropriately influenced decision making, resulting in tragic outcomes.

This issue is further compounded by the nature of the very process by which we conceptualise risk, the risk management process itself, which works well in most everyday uses. However, when really needed in complex situations of high uncertainty, fails to live up to expectations.

Limitations of current approaches to risk management

The existing philosophy and methodologies for risk assessment arise from early actuarial concepts used to establish risk levels for insurance purposes (reviewed in Bernstein, 1996). Such approaches are based upon an assumption of the normal distribution of potential event consequences and their likelihoods, and as such generally work well over a wide range of applications. However, these traditional techniques struggle in situations where the potential consequences may be extremely severe, the probabilities are exceptionally low and the uncertainty is very high. The very non-routine circumstances that can arise in fast moving volatile emergencies.

In such circumstances traditional risk management techniques (upon which, for example, the international standard ISO 31000 is based) begin to extend beyond the very limits of their validity (Taleb, 2007; Hubbard, 2009). Our current risk management approaches are based upon a very linear concept of cause and effect that exist only in relatively simple systems (for example based upon one cause creating one effect and usually characterised by one question yielding one answer). These approaches are less effective in dealing with complicated systems[10]. Our traditional risk management techniques become largely ineffective when dealing with complex systems, where multiple causes interact to create multiple effects. They are even further limited by their reliance on assigning probabilities to future consequences, a problem when it is exceptionally difficult to anticipate the outcome of complex systems in advance (Sargut and McGrath, 2010). When there is a transition to a complex system, such linear analytical techniques show very limited utility.

Routine front line operations are usually conducted in a range from simple to complicated systems, and hence lend themselves to analysis by traditional risk management approaches. As we transition to non-routine context (complex system), such linear techniques no longer apply.

It is apparent therefore that the majority of commonly used risk management techniques do not cope well with identifying and analysing the dynamic environments experienced by emergency services operations facing high consequence/low probability risk.

[10] where a single cause can create multiple effects and where one question will yield multiple answers.

The importance of intuition in novel situations

In front-line firefighting operations, firefighters often substitute the formal risk assessment approaches for a 'gut feel' about the types and levels of risk they are facing. Such an approach, which is based upon sound scientific principles, is valid and in some circumstances may be far more appropriate and accurate than more formal approaches.

The concept of intuition and in its basis in pattern recognition lies at the foundation of the 18th century Goethe's scientific methodology (reviewed in van der Bie, 2012; Myer, 2007), and along with the role of emotional cues, is now supported by a range of psychological and cognitive scientific studies. This includes the work reviewed by Kahneman (2011) into systems 1 and 2 thinking types.

Intuition plays a key role in decision making, and is essential in situations which require an automatic response. For example, when a hazard suddenly becomes apparent (such as child running in front of a truck), there is an automatic response to take the foot of the accelerator, push down on the foot brake and swerve. Similarly, when a process (such as changing up or down gears in a vehicle) becomes highly practised, performing it becomes effortless, it becomes automated or intuitive. In such circumstances, the major expenditure of energy is on taking action, not in analysis and weighing up options (Figure 5.2).

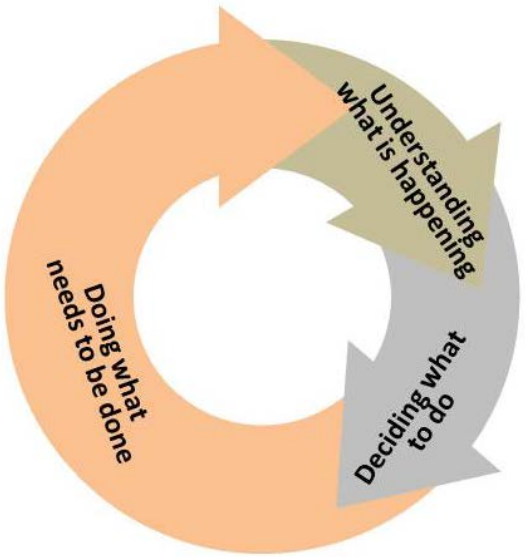


Figure 5.2: Energy expended during an intuitive response

Conversely, when there is more time available, a more considered response can operate, where a significantly higher proportion of effort is expended on the cognitive processes (Figure 5.3).

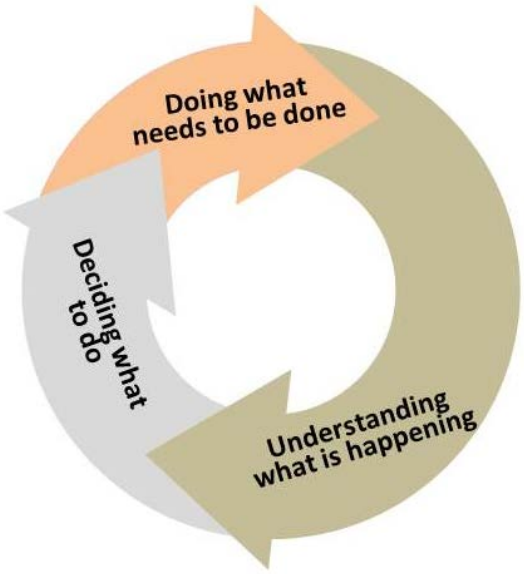


Figure 5.3: Energy expended during a reflective response

Whilst there are occasions where either an intuitive or a reflective response is preferred or required usually both types of response work systematically and synergistically together. The intuitive response fires off immediately, followed more slowly by the reflective response which either reinforces or modifies the initial response.

With increasing expertise, the 'wiring' of the brain changes to an extent where recognition of patterns (what is recognised in the information being received) become rapid and automatic. The information is processed and decisions made without any real consciousness of how the decision was arrived at. In the vast majority of cases, this process is highly efficient and highly effective. It is what allows experts to make rapid judgements (reviewed in Gladwell, 2005). It is also effortless, so is usually the preferred mode of operating. However, the intuitive/automatic response does have its drawbacks, because it is so effortless it is used in some circumstances where it is inappropriate, and sometimes is dangerous. In highly complex environments, there may be patterns that seem familiar, and this automatic system 'fires off'. Although, the patterns may seem familiar, in reality they may not be and an inappropriate decision is made.

Kahneman's review of the intuitive or automatic mode of thinking, what he refers to as 'System 1' (Kahneman 2011) underlies what experts often regards as their 'gut feel' for a situation. This System 1 is the immediate responder to familiar patterns and has been the foundation of humanity's survival (see orange and black stripes moving through the tall grass – freeze - it's a tiger, maybe). System 1 becomes the preferred mode in apparently familiar circumstances, it is effortless, automatic and very fast. A lot of the time it is 'spot on', but many times it will be misleading or inappropriate. It, therefore, exists in a balance with a slower, more effortful and more considered 'system 2' (Figure 5.4).

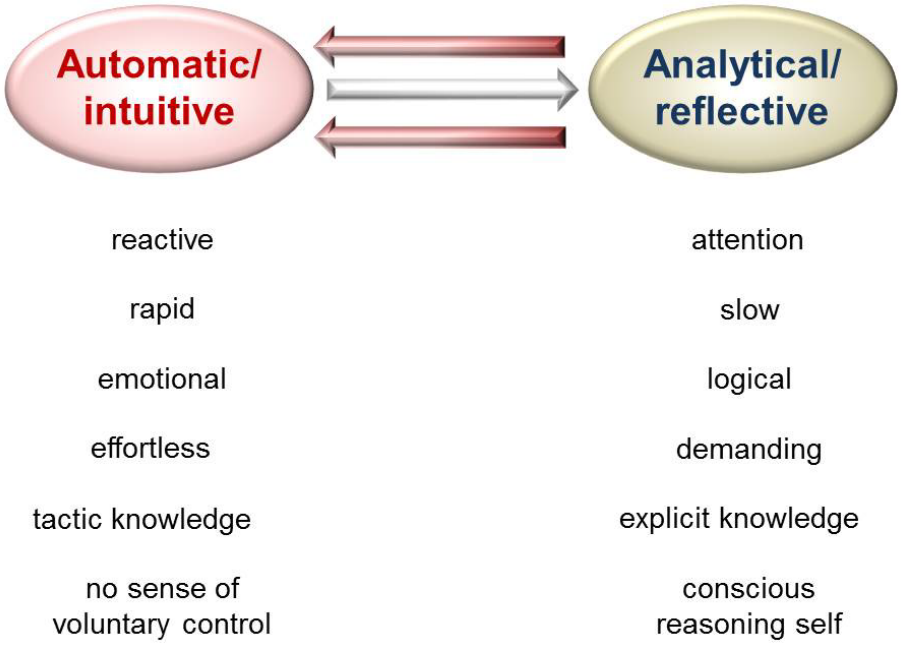


Figure 5.4: Automatic/intuitive response vs analytical/reflective response

System 2 thinking can be more usefully referred to as the 'reflective/analytical response'. However, this response is 'lazy', it requires considerable effort and is far slower to process information and arrive at a decision compared to an intuitive response. Analysis and decision making can be forced in the direction of a reflective response, which can be facilitated by training and frameworks.

One such approach to force a change into reflective and analytical thinking has been the move towards dynamic risk assessment. It provides some structure to help individuals shift from the automatic/intuitive to the reflective/analytical response. However, given the linear processing that our current risk assessment approaches are based on, this places some substantial limits on the ability of the reflective/analytical thinking to adequately play its part. Dynamic risk assessment requires effort, it needs users to consciously focus attention in an environment where speed of change and emotion will naturally push towards an automatic/intuitive response. One problem is that the way in which dynamic risk assessment is approached in practice does not effectively capture the automatic/intuitive response. This is where techniques to better focus the mind can provide some significant advantages.

Intuition and analysis are both critical to cognitive functioning and hence to effective decision making. The real issue concerns those circumstances where one response may provide a more appropriate outcome, and a means to resolve conflicts between them.

What is required is a framework that can improve recognition and acceptance of intuition, improve speed of recall and reaction, and incorporate it, when required into a more inquiring thinking and deliberative action processes. Obviously, mindfulness techniques can assist in this, through expanding awareness and focusing attention.

Meanwhile, HRO principles provide some structure and direction for further focusing attention and driving deliberative thinking, whilst action learning techniques provide a means by which to use and improve on this HRO based approach. However, there has been no framework that effectively brings together our current (and usually effective) methodologies and practices with emerging capabilities.

What is required is an approach that can utilise what we already have, but provide suitable adaptation to highly dynamic, highly complex environments. Out of the recognition of the problem, that arose from the scholarship, Gibson and Pupulidy have since further developed and codified the novel concept of 'Margin of Manoeuver'.

Margin of Manoeuver – an answer to unasked questions

Background

Put simply 'margin of manoeuver' (MoM) is a reframing and integration of a range of current techniques that we already use to observe our environment, detect expected and unexpected change within it, make decisions about options for responding to these changes, and determining how effective our responses are. It also provides the opportunity to include and integrate the novel approaches emerging from HRO, mindfulness and neuroscience.

The term 'Margin of Manoeuver' has been used previously as a simple abstract concept to represent a vague bounded space within which one can operate, and has been applied to a range of different contexts, including: military and armed conflict (Porch and Rasmussen, 2008; Ferraya and Segura, 2000), illegal drugs control (Chabat, 2002), political leadership and diplomacy (Amr, 1988; Eisenstadt, 2010; Gresh, 1998), sovereign economies (Capistran, 2011) , international development (Arenas-García, 2012), change and competition (Ermakoff, 2010), jurisdictional and international policy (Kaiser, 1971), work organisation (Chatigny, 2000), etc.

The term has been more narrowly used to define a boundary limit to safe operating (Gotcheva, et al, 2013) and in safety engineering as an "ability to respond to changes in patterns of demands" (Woods, 2011), or "information on the systems flexibility in terms of actions and resources" (Rankin, 2013). Chan (2012) built upon Woods' earlier work and has considered margin of manoeuver in defining resilient control systems as a measure of system brittleness. Their work has yielded some relatively narrowly focused theoretical concepts that have, as yet, not found practical use in an operational context.

Practical application of MoM: a basis for investigating serious accidents

A few days of the study visit were spent working with Ivan Pupulidy on the completion of a serious accident review – the Saddleback fatality (Appendix F) and in discussion with Professor Karlene Roberts on the application of HRO thinking in this context.

On 10 June 2013, Luke Sheeney, the Incident Controller of a three man smokejumper team was killed by a falling white pine split crown whilst constructing a control line around the burning tree.

The accident review into this tragic fatality utilised a different methodology from a conventional accident investigation, in a variety of different ways:

- The review was not pitched as an accident investigation, but rather as a learning review, which established the tone by which the whole process was conducted.

- Information was gathered by a dedicated Data Collection Team;

- This information was then passed onto a separate Sensemaking Team, which in addition to reconstructing the 'facts' and creating a narrative, went beyond the original interviews with those involved in the accident, interviewed other firefighters with relevant experience to create a wider sense of the context;

- The process involved a deliberate attempt to suspend hindsight perspective in order to remove hindsight bias whilst at the same time trying to put the reviewers into the context that the participants were experiencing at the time of the accident;

- By being able to understand why it made sense for each participant to think and act the way that they did at the time, it helps to better understand the brittleness and resilience of the system;

- A conscious decision to not draw definitive conclusions from the review, as this may have proven to be a barrier to further learning, but rather to allow the vagueness and unresolved issues to emerge;

- A driving aim of the approach to this review was to trigger dialogue within the firefighting community to create better involvement in the learning;

- Another aim was to introduce (and in some cases reintroduce) new learning products to the reader in order to improve broad collective sensemaking;

- As an approach, the Learning Review built upon the concept of creating a narrative to engage readers in this collective sensemaking

The Learning Review utilised a number of techniques to explore the accident, identify the learnings and create a learning narrative:

- ***Sensemaking:*** based around how each individual made sense of the situation for themselves, and how those individuals interacted to create a shared meaning (organisational sensemaking), usually through dialogue amongst participants. In this respect organisation could refer to a crew, team, or the functional organisation as a whole.

- ***Consideration of pressures and filters:*** pressures represent those external factors that are acting on the system and can range from regulations, organisational policies, budget constraints, cultural constraints, and stakeholder/community demands through to environmental conditions such as tactical demands, weather patterns and landscape. Filters represent aspects of individuals that affect how information is identified, collated and analysed and includes factors such as:
    - values and beliefs,
    - previous experiences and memory,
    - emotional affect,
    - training and level of expertise,
    - assumptions,
    - attentional capabilities,
    - interpersonal relationships,
    - personal concerns and worries etc.

- ***Use of mind mapping:*** to delineate the interconnectedness and connectivity of perceptions, thoughts, relationships and events.

- ***Margin of manoeuver:*** in this Review the concept of margin of manoeuver was still in its embryonic stages and was conceptualised as the amount of operational space that a crew had available or could create and within which it functions and makes decisions. Internal and external factors can influence the size of the margin, either increasing or decreasing it.

The further development of Margin of Manoeuver

The development of the concept of Margin of Manoeuver has continued as independently funded research conducted by Ivan Pupulidy and Dr Carl Gibson outside of the ESF scholarship but is summarised here for completeness. This work has generated several research papers with the intent of publication in 2014.

Margin of Manoeuver – a conceptual construct

We have defined Margin of Manoeuver (MoM) as:

"The capability space to cope with current demand and future challenges arising from volatility and uncertainty".

We envisage MoM as a three dimensional space akin to a sphere that can expand or contract according to changing external pressures and internal capabilities. Individuals and teams are therefore continuously challenged by forces 'pushing inwards'[11] on the boundaries of this MoM sphere. This is countered by forces pushing outwards[12] until an equilibrium point is reached. The smaller the size of this sphere, the less room teams and individuals have to make sense of their environment, decide on appropriate actions and enact them effectively. The more restricted that MoM becomes, the more safety and performance will degrade, until MoM becomes so restricted that a catastrophic failure ensues.

This counteracting of the pressures reducing MoM is under individual, team and organisational control. Mechanisms can be put in place to allow a controlled expansion of MoM, not only as a response to external pressure, but also as part of preparedness.

[11] Forces generally outside of the control of the individual or team.
[12] Forces usually wholly or partly under the control or direction of the individual or team, by may also include independent forces that either deliberately directed to assist or do so incidentally.

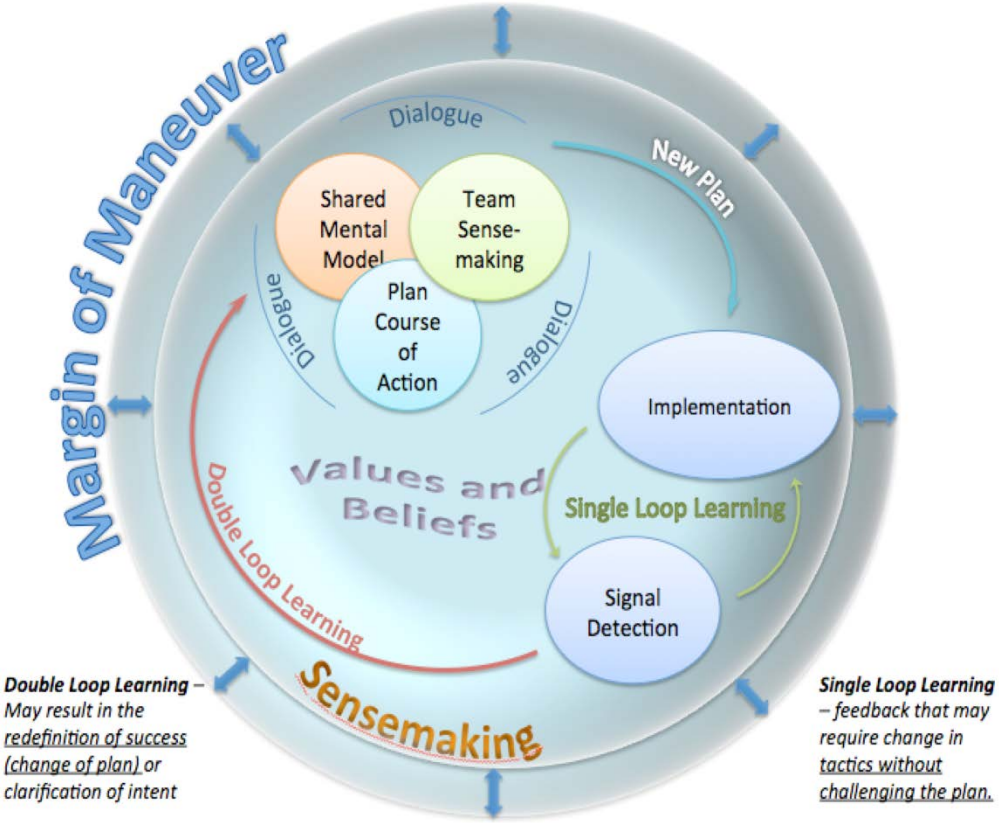


Figure 5.5: Margin of manoeuver as part of an integrated framework of sensemaking, communication and critical thinking

Sensemaking provides a key mechanism by which MoM expands or contracts, both from the aspect of an individual's sensemaking, and the effectiveness of creating a shared sense within a team (Figure 5.5). Most commonly, sensemaking occurs through single loop learning. A signal (relevant packet of information) is detected, it is made sense of, a decision on possible response options is made, and the preferred option is implemented. The change arising from this implementation is detected as a new signal forming a feedback loop which may result in modification to the analysis, with subsequent modification to the actions. Through such learning loops, behaviour and actions can be adapted to better fit changing circumstances and hence begin to create an expansion in the MoM boundary.

Such single loop learning generally works well in routine, simple and well understood environments. As complexity increases, such learning becomes less effective. Hence the ability to expand MoM becomes increasingly constrained, until the tipping point is reached and MoM starts to contract. In some circumstances, maintaining or expanding MoM becomes increasingly dependent upon the individual's or team's ability to engage in double loop learning. In double loop learning the actual nature of the strategy or plan is questioned whereby goals and objectives may be reframed. For example in single loop learning we are continuously trying to adjust the approach by which we are trying to achieve the set goal.

In double loop learning, for example we recognise that the environment is changing so dramatically that the original goals and objectives may no longer be relevant, and new goals and objectives, even values and beliefs, need to be reformulated. This revaluation and reformulation needs to occur not just for the individual, but also with those that they interact with. Hence the criticality of shared sensemaking. Double loop learning therefore provides the necessary 'powerhouse' to continue the outward push against the MoM boundaries as complex change continues to push inwards.

In a stable environment, with an individual, team or organisation that are performing acceptably, they would be operating well within their MoM. Whilst within their MoM they would be expected to continue to achieve their objectives to required levels, and to be doing well within the tolerances of acceptable safety parameters. As the size of MoM reduces, or the scope of work expands (without a corresponding expansion in MoM), the activities will extend beyond the MoM boundary, which once exceeded results in deteriorating performance and unacceptable exposure to harmful risk (which can be more than just safety risk).

Margin of Manoeuver: a practical construct

In practical training on MoM, it can be most easily visualised using as simple prop – the Hoberman Sphere, which can be expanded and contracted at will (Figure 5.6) to demonstrate increasing and decreasing MoM.

Figure 5.6: using the Hoberman sphere as a visual aid to MoM

The Hoberman sphere has been used successfully as a MoM training aid for US firefighters, whilst the concepts of MoM have been piloted to recruits and operational volunteers at one Brigade as part of fire season preparedness training (Figure 5.7).

Figure 5.7: Post minimum skills –CFA volunteer firefighter using a Hoberman sphere to visualise changing MoM

Trialling of the concept of Mom to date has been encouraging and has shown that personnel rapidly and intuitively pick up the concept. Personnel have been able to use MoM to quickly assess the level of risk within a situation and determine if their original course of action would result in increasing or decreasing their MOM. In groups they have then been able to rapidly evaluate options to identify actions that would increase their MoM, and as importantly, identify those options that could reduce their MoM. MoM has also seen some initial use on the fire ground during the 2013/14 fire season.

Training conducted both in the USA and in Victoria up to date has only demonstrated the most simple evolution of the MoM concept. A more robust model is currently being developed.

In using MoM, five key elements are considered (Figure 5.8):

- ***Sensemaking***: the means by which information is collected and analysed (made sense of), and is created from a basis of understanding existing patterns of cues and the new patterns that arise as a result of sensemaking itself. It comprises:
    - *Acuity*: understanding how previous experiences and trends can aid intuition, but also how emotional and perceptual biases can be created, how to recognise and pay attention to early warning indicators of change.

- *Monitoring* self and team's changing capabilities, particularly any change in ability to meet changing conditions, recognising how capability may cope with or need to change to meet emerging or future potential demands.
- *Reflection*: continuing to step back and reviewing how the mission objectives relate to a changing environment.
- *Shared sensemaking*: one of the key outcomes of effective sensemaking is the creation of a shared narrative, which captures and conveys an agreed understanding for all participants. The narrative element itself lends towards improved attention, recollection and application by the very way in which it stimulates both emotional and cognitive networks within the brain.

- ***Goal alignment:*** is closely intertwined with sensemaking; considering the degree to which original goals continue to align with the over-arching mission goal, and how relevant goals and objectives are given the changing demands and pressures arising from the continuous change in operational conditions. This involves a continual challenge to goal relevance and determining if and how the original objectives need to be reprioritised or reformulated and subsequently promulgated.

- ***Systems capability:*** comprises interconnected processes such as systems of work, systems of safety, information systems, supply systems, measurement, monitoring and reporting systems. In essence those webs of processes by which key objectives are to be achieved. Also it is these processes that may become compromised and degrade as external factors drive against the boundaries to effect a reduction in MoM. Additionally, of consideration are factors such as redundancy, robustness, reliability and resilience of systems in the face of changing challenges and demands.

- ***Resource capability:*** includes all classes of resources that are utilised by or form dependencies for key systems including finances, human capital (particularly expertise), plant and equipment, communications consumables and other physical and virtual infrastructure. In understanding resource capability and its effect on MOM; ability, quantity and access are key considerations particularly as access to those resources may improve or degrade over time. It is not just the concept of degree of access that is important, but also the speed or rate by which such access may change. Resource capability also needs to consider that with utilisation over time, resource capability will decrease as resources become depleted or fatigued. For human resources the effects of emotion, confidence, trust, and mutual support also need to be factored in. As with systems, redundancy, robustness, reliability and resilience of resources will also substantially influence the MoM.

- ***Leadership capabilities:*** considers the traditional leadership attributes such as the ability to, direct and assign resources etc; i.e. the typical command, control and coordinate skills and responsibilities which form the toolkit for routine conditions. However, in volatile environments other attributes increase in importance, such as
    - ***emergent leadership***: demonstrated by the willingness to operate out of the conventional role and step up to take on new, often informally recognised responsibilities. This is often characterised by less senior members of a team 'rising to

the occasion'. Research has indicated that a crisis situation can serve as a potent catalyst for the emergence of 'charismatic leadership' (Pillai, 2007). These 'charismatic leaders' are then regarded as more effective during the crisis than those in leadership roles in non-crisis situations. Emergent leaders are generally viewed as being 'transformational' compared with the more routine 'transactional' aspect of leadership. Charismatic leadership has been shown to arise from a combination of:

- the specific behaviours demonstrated by the leader,
- personality traits of the leader,
- perceptions of followers and the attributes that they assign to the leader;
- the specific effects that the leader has on the followers.

A factor in allowing the emergent leader to 'emerge' during a time of crisis may be the propensity of people to shift the level of importance that they place on a range of leadership attributes to a much stronger focus on the charismatic attribute. Other identified factors contributing to leadership emergence include:

- Intelligence or cognitive ability of the leader. A number of research studies show that intelligence is very strongly related to leader emergence and performance (reviewed in Mumford, et al, 2007). As complexity and ambiguity of task and environment increase, the requirement for cognitive capability increases, particularly with respect to evaluative skills.
- The ability to create a compelling vision and purpose whilst a critical success factor in effective routine leadership, it becomes a major differentiator during a crisis.

In routine leadership, the ability to create a compelling vision is a critical success factor. However, it becomes the major differentiator during a crisis.

- ***Behaviour:*** the old adage of 'leading by example' has a crucial place in the positive affective role of leadership in MoM. Having a team adapt their own behaviours to align with positive traits exhibited by their leader is a more powerful and sustainable condition than trying to achieve such behavioural change through training and reward mechanisms alone. Such positive alignment is more readily achieved in the presence of charismatic leadership than when exposed to more directive or dictatorial forms.

- ***Empowerment:*** the concept of empowerment is closely related to the HRO principle of 'defer to expertise'. The key requisites for engaging empowerment are:
  - Recognising that expertise does not always map to hierarchy and seniority,
  - Establishing a culture of trust, that leaders have to have trust in those that they have delegated responsibility to, and equally that 'delegates' have trust in their superiors. In this there is a strong association with the concepts of a 'just culture' where it is recognised that mistakes will happen and that error represents a learning opportunity, not an occasion for punishment.

- ***Motivation:*** There is substantial research that shows that traditional "carrot and stick" reward mechanisms are far less effective than is popularly believed. Accepted reward

and recognition programs provide motivational drive only in those circumstances where routine tasks are being undertaken. In more complex work environments such approaches, counterintuitively, can have a deleterious motivational effect (reviewed in Pink 2009). Research and practice demonstrates that motivation can be enhanced through creating an environment that encourages:

- *autonomy*, which foster improved engagement, which in turn encourages team members to develop -
- *mastery*, particularly mastery over non-routine tasks and mastery in complex problem solving. In this respect mastery is not so much gaining a competency as creating a new mindset. To provide a framework within autonomy grows and mastery develops, a third element is required –
- *purpose,* the establishment of meaningful goals which sets the context for autonomy and mastery to develop within.

- ***Sensemaking***: not just from the aspect of the leader's competence in sensemaking, but also in their ability to foster shared sensemaking within and across teams. Leadership's primary role in sensemaking is to create a cognitive structure that will facilitate an understanding of and an ability to respond to dramatic change.

- ***Experiential knowledge:*** There are multiple forms of knowledge upon which general leadership capability is based, including spatial knowledge (ability to create a mental map of one's whereabouts and of the surrounding environment), schematic knowledge (where information with similar features is grouped together), associational knowledge (being able to associate signals with courses of action), tacit knowledge (includes explicit knowledge that has been encoded to provide hunches, intuition and insight). However, these types of knowledge are contextually based, and therefore can have limited application where the context is subject to volatile change. In such circumstances, it is likely that experiential knowledge provides the basis for emergent leadership under non-routine conditions of high uncertainty and volatility.

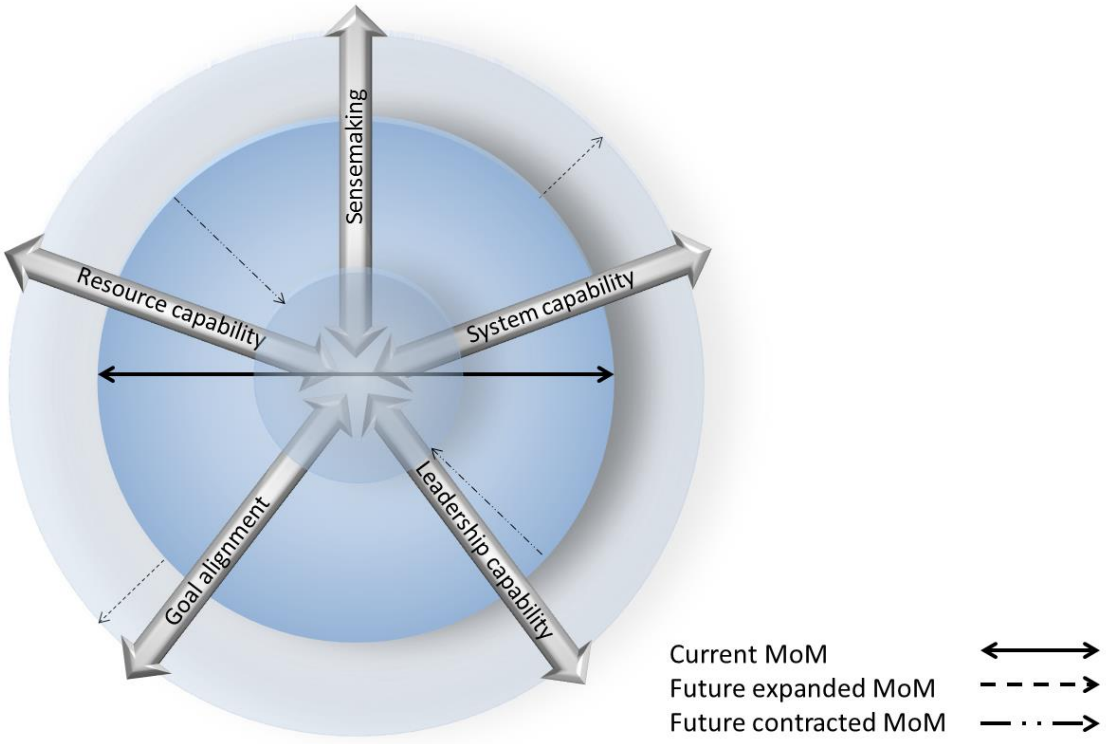


Figure 5.8: Key enablers of Margin of Manoeuver

A practical guide (in the form of a laminated aide memoire) has been developed for assessing any increase or decrease in MoM (Figure 5.9), and forms the opposite side to the On Action Review aide memoire (Figure 1.6).

MoM is not a new discipline or replacement for tried and tested methodologies. Rather it is a different lens for examining and assessing our internal and external contexts in a more intuitive, organic and integrated manner. It provides a means for coping with the artefacts and anomalies that are created (and usually unnoticed) by applying linear thinking and linear methods to solving complex problems. As such MoM is not just focused on operational issues, but provides a robust framework that can be applied to both tactical and strategic use.

Figure 5.9: Pocket aide memoire for assessing MoM

There are therefore five important aspects of MoM, it provides:

- A means to assess current capability to cope with the challenges being faced at that moment;
- Foresighting capability to identify and better understand potential future challenges;
- A cognitive framework within which decisions can be made and promulgated.
- A cognitive framework with which to develop and enact solutions to these challenges;
- An audit assurance mechanism, for use both internally and by third parties, for the level of strategic and operational capability and preparedness.

Chapter 6: Bringing it all together

Findings from the scholarship

This research study has examined new developments and emerging thinking in the areas of:

- The application of high reliability organising concepts to emergency services operations;
- The role of mindfulness in enhancing learning and preparedness, and in recovering from non-routine events;
- Emerging findings from neuroscience research that is showing how the mind and emotions function under stress and how this can create problematic thinking and actions;
- Applying new thinking to learning from accidents and other non-routine events and improving safety and operational performance; and
- The application of integrated performance improvement programs (such as 'Corporate Athlete' and "Comprehensive Soldier Fitness') to training and preparedness of combat troops and firefighters.

The research study has provided access to existing training methodologies, which with adaptation, can be applied in a Victorian context as standalone modules. The research has also provided the foundation for the development of a new teaching and learning schema, by which many of these findings can be incorporated as enhancement to a wide range of existing tactical and leadership training offered currently by agencies. For example, an understanding of how mind and emotion interact to affect memories, thinking and decision making can be applied across multiple disciplines.

The research study has also fostered collaboration that has allowed diverse knowledge to be codified in a manner that now lends itself to teaching and the continuing development of practical applications. One of these practical applications that has been developed following completion of the Scholarship has been the establishment of the MoM concept, in which pilot training has already commenced. MoM has also been reviewed by several State Government agencies and has been introduced into the assessment application for assessing criticality and vulnerability of the State's critical infrastructure and declaration of essential services.

Next Steps

The findings from the research study provide new insights into the cognitive processes that contribute to high levels of strategic, operational and tactical performance. This work also provides direction for some small but fundamental shifts in the way that training and continuous learning is undertaken.

Tangible performance results can be achieved through the adoption of techniques derived from neuroscience, psychology, high reliability organising and mindfulness practices.

The conduct of this scholarship has demonstrated that these different fields of endeavour are actually closely interrelated, and have direct effects on our preparedness, understanding of risk, and our performance (Figure 6.1). When combined into an integrated package this can provide a powerful development and learning program, an enhanced and intuitive way of understanding and responding to change, and a mechanism for lessening the harmful effects of stress that arise from this change.

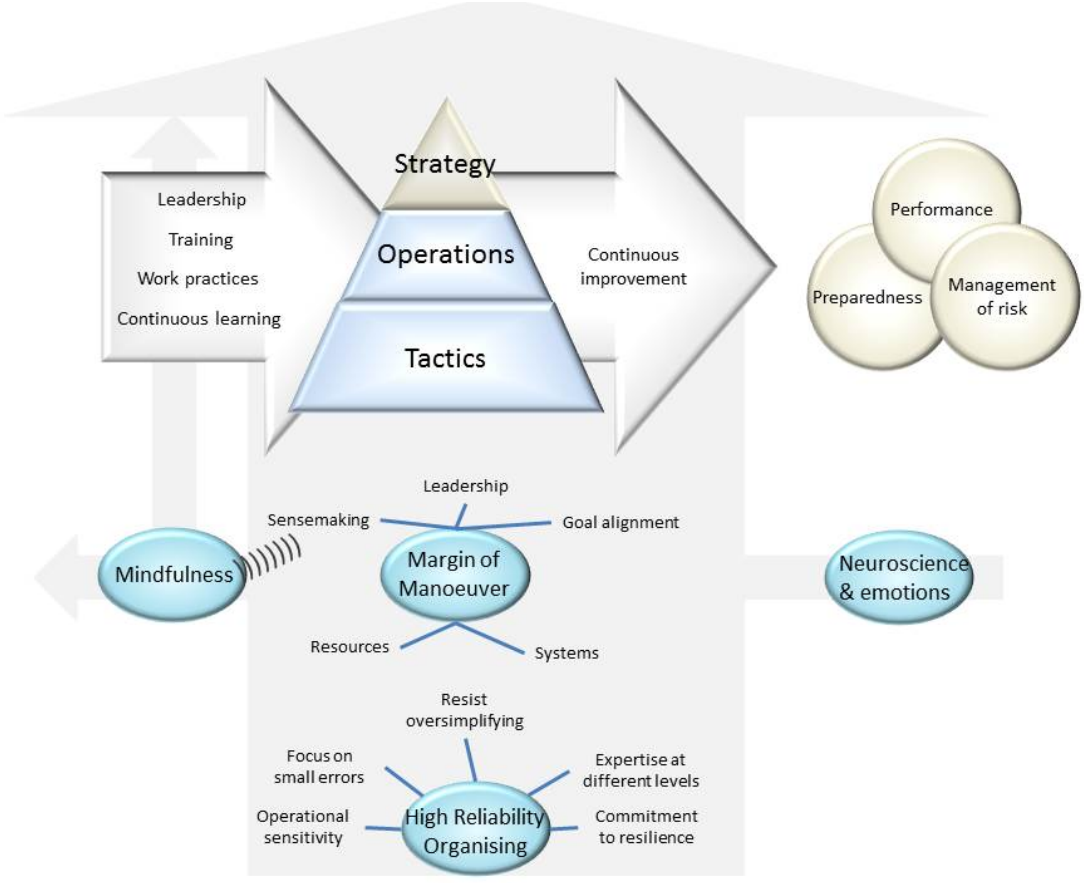


Figure 6.1: An integrated approach to continuous improvement

Ideally, an intensive and comprehensive workshop covering all aspects of the findings of the study would provide the most effective way of developing new cognitive competencies and practices. However such a time commitment (minimum of 2 days classroom training, with continuing field practice) is likely to be unfeasible at the moment.

However, a basic grounding in the concepts can be introduced as a minor component into many areas of existing technical, professional and leadership training. A working knowledge of Margin of Manoeuver, sufficient for its use as a safety improvement tool could be attained form one to two hours training.

A full modularised curriculum is presented:

Curriculum

Module 1: Setting the scene

- Understanding the nature of our changing social, political, legal, economic, technological and natural environments and the changing nature of challenges and demands.
- Understanding the nature of crises, disasters and catastrophes.
- Looking at the causes of crises and disasters.
    - Case study – Kings Cross Fire
- An examination of routine and non-routine – simple/linear versus complex systems.
    - Case study - Bradford City Football Club fire
- Limitation of our current approaches in complex systems.
- Emerging thinking on resilience.
    - Case study Katrina

Curriculum

Module 2: The role of cognitive competencies

- Brain - mind relationship.
- Structural and functional relationships.
- Intuition and reasoning.
- Adverse effects of lifestyle and stress.
- Impacts on perception and judgement.
    - Perception exercise
- Memory and encoding experience.
- Positive and negative emotions.
- Emotional style inventory
    - Emotional style exercise
- The role of emotional and analytical mental processes.
- The effect of emotion on decision making.
- The creation of leadership types.
- The leader's mind in a crisis
    - Cognitive demand exercise.
- Countering strategies.
- Mindfulness techniques and practices

Curriculum

Module 3: Applying Margin of Manoeuver

- The basis of personal, team and organisational resilience.
- Traditional approaches to assessing and managing risk.
- A primer on high reliability organising.
    - Case study – Willow Creek helicopter rappel fatality
- From situational awareness to sensemaking.
- The transition from 'novice' to 'expert'.
- The role of intuition in routine and fast moving contexts.
- An overview of System 1 and System 2 thinking.
    - Exercise – intuition in action.
- An alternative lens – Margin of Manoeuver.
- Improving operational safety with Margin of Manoeuver.
    - Case study- Saddleback fatality.
- Improving incident management team performance with Margin of Manoeuver.
- Improving strategic decision making with Margin of Manoeuver.
- Application of Margin of Manoeuver to learning from incidents – the learning review.

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