

Culture, CRM and aviation safety

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Culture: *"the collective programming of the mind which distinguishes the members of one group from another"*

(Hofstede, 1980, p. 21).

Aircraft and other industrial mishaps are now investigated with a view to comprehensively examining the systemic factors which may have contributed to the occurrence and the context within which they take place. The aviation psychology and human factors community has contributed significantly to the development of systemic investigation methods, in addition to techniques aimed at the prevention of accidents. The development and maintenance of appropriately targeted selection methods, comprehensive and operationally relevant human factors training programs, thorough systemic investigation techniques, and a positive safety culture can have a direct impact on the bottom line of organisational safety. Also important are the various cultures within which the world's aviation professionals carry out their operational duties, and the fit between those cultures and proposed safety solutions (eg., CRM training). This paper will examine the broader notions of culture, CRM, and aviation safety, and will discuss methods available to organisations to enhance their operational safety performance.

Fifteen years ago, it would have been difficult to foresee the extent to which we now view industrial mishaps as "organisational accidents". While much is still to be achieved, it is encouraging to see the depth to which some investigations now delve when attempting to get to the bottom of accident causality. Elements of the aviation industry have been leaders in the move towards a more enlightened consideration of the precursors to accidents and the contexts in which they occur. The Australian Bureau of Air Safety Investigation (BASI) is one such element, and BASI's reports on the 1993 Piper Chieftain accident at Young in New South Wales (Bureau of Air Safety Investigation, 1995) and the landing of a B747 at Sydney Airport with its nose-wheel retracted in October 1994 (Bureau of Air Safety Investigation, 1996), are excellent examples of the growing trend towards the systemic investigation and reporting of aircraft incidents and accidents.

Aviation and Australia are not alone in the search for deeper roots to accident causality. Amongst others, reports on the sinking of the *Herald of Free Enterprise* channel ferry (Sheen, 1987), the King's Cross Underground railway station fire (Fennell, 1988), the Clapham Junction railway accident (Hidden, 1989), and the March 1989 crash of an F-28 at Dryden in Canada (Helmreich, 1992; Moshansky, 1992; Maurino, Reason, Johnston & Lee, 1995) provide testament to this, comparatively recent trend. They also add weight to the argument for a change in traditional yet rudimentary thinking regarding operator error, previously exemplified within aviation by widespread use of the term "pilot error". As observed by Lee (1996), if accident investigators continue to concentrate only on traditional "sharp end" factors, then the investigation agency itself becomes part of the safety problem.

Understanding human error

A growing interest in developing our understanding of the antecedents of human error has precipitated an evolution towards a more thorough understanding of industrial mishaps. In particular, the work of Professor James Reason (1990, 1991, 1993, 1994) and his modelling of organisational accidents has been responsible for widespread improvement in the

understanding of the causes and consequences of human error. Helmreich (1993a) employed Reason's notions of latent organisational pathogens, together with his own model of flight crew performance (Helmreich & Foushee, 1993) in a systemic analysis of the Avianca B707 fuel exhaustion accident at Cove Neck, New York. The approaches of both Reason and Helmreich are further explored and synthesised by Zotov (1996) in his thought-provoking proposal of an improved format for the investigation and reporting of the human factors of aircraft accidents. Paries (1996) also contributes substantially to the development of our thinking on aircraft accident investigation with his discussion of an evolutionary shift of the aviation safety paradigm towards systemic causality and proactivity. Johnston (1996) provides an overview of this shift in his broader consideration of philosophies for systemic risk management.

Notions of culture

Underpinning much of the work on human error are notions regarding the influence of culture on individual and group behaviour. In spite of the belief of some observers that it is possible to create "culture free" work environments, there is little doubt that there are a variety of cultures within which aviation professionals carry out their daily duties which impact significantly on the operations of the world's airlines. While national culture was the first of these to come under scrutiny, there is now a growing recognition amongst researchers and practitioners that a range of sub-cultures exist (eg., organisational, vocational, occupational, safety) which also impact directly upon our professional and interpersonal behaviours in the work place. While a solution to creating a culture-free work environment has been proposed - "...fill it with Australians" - (Hamilton, 1992), in practice even this does not work and it is evident that we are all, to some extent, culturally-bound in terms of our behaviours and attitudes.

National culture

The seminal research of Hofstede (1980, 1991) laid the foundation for the considerable body of work which has since examined the role of national culture in relation to flight crew behaviour and safety on the flight deck (eg., Ooi, 1991, 1992; Johnston, 1993; Maurino, 1994; Merritt, 1993, 1996). Hofstede isolated four dimensions on which national cultures can be classified. Two of these dimensions are particularly relevant to the way teams function within aviation. One defines the nature of relations between subordinates and superiors (*Power Distance*), and the second (*Collectivism v Individualism*) reflects group interdependence versus independence. Anglo-Western influenced cultures tend to be high in individualism, and moderate to low in power distance. Many Asian and Latin-based cultures are collectivist, and high in power distance. As observed by Smith and Bond (1993), Hofstede's original work avoided the "ecological fallacy" that others have frequently implied from his findings; eg., that because Australia scores higher on his dimension of *Individualism* than Indonesia, then a particular Australian must be more independent or individualist than a particular Indonesian. Hofstede's mean scores represent the average of the scores of those who responded to the questionnaire.

The work of Ashleigh Merritt (1993, 1996) explores cross-cultural similarities and differences with respect to attitudes toward flight management and the link to safe operations. Using the NASA/UT Flight Management Attitudes Questionnaire, Helmreich and Merritt (1996) were able to identify some attitudinal characteristics which appeared to be "universally" applicable to airline pilots, and some in which large differences were displayed between the various cultures which made up their sample, as illustrated in Table 1.

Table 1
FMAQ Pilot "universals", and items showing significant cross-cultural differences in 19 organisations (Adapted from Helmreich & Merritt, 1996)

Flight Management Attitudes Questionnaire Items – COMMUNICATION, COORDINATION, COMMAND & STRESS	% Agreement across 19 Orgs
<i>Universals</i>	
Good communication and crew coordination are as important as technical proficiency for the safety of flight.	85-100%
The captain's responsibilities include coordination between cockpit and cabin crews.	85-100%
The pre-flight briefing is important for safety and for effective crew management	85-100%
The pilot flying the aircraft should verbalise plans and be sure the information is understood and acknowledged.	85-100%
I like my job.	85-100%
<i>Significant cultural differences</i>	
Crew members should not question the decisions or actions of the captain except when they threaten the safety of the flight.	15-93%
If I perceive a problem with the flight, I will speak up, regardless of who might be affected.	36-98%
Personal problems can adversely affect my performance.	38-78%
I am more likely to make judgment errors in an emergency.	17-70%

In her doctoral study, which attempted to replicate [Hofstede's original work with IBM²](#) within the airline community almost three decades later, [Merritt \(1996\)](#) met with considerable success.³ Her results indicate that aspects of airline pilot work such as communication and teamwork were acknowledged as universally important by those who took part in the study. Attitudes toward stress reflected a strong (but seriously mistaken) pilot attitudinal norm that the true professional is invulnerable to environmental stressors. (An extreme example of this - manifested by feelings of invincibility and disproportionately high risk-taking - can be found in Kern's (1995) fascinating case study of a USAF B52 accident at Fairchild AFB.) This result has implications for the effectiveness of CRM training, and will be discussed in that context below.

The strongest cross-cultural differences found by Merritt were in the areas of command (Hofstede's 'dimension of *Power Distance*) and flexibility with rules and routines (*Uncertainty Avoidance*). Pilots from "Anglo" countries (USA, Australia, New Zealand, Ireland, and British born pilots based in Hong Kong) held very similar views, while amongst the non-Anglo countries, the more hierarchical command styles were differentiated by the relative importance allocated to rank (Brazil), rules (Taiwan), and relationships (Philippines). The unequivocal finding of the study was that national culture is a powerful

influence on work performance, and that pilot training and international aviation regulations should reflect an awareness of this.

Much of the work on culture focuses on the seemingly apparent and generalisable differences between mainstream eastern and western cultural values. However, this is a very blunt tool with which to examine cultural differences. If we look at geographically small and contiguous regions of Europe, for example, we can observe rather significant differences in the thinking, attitudes and behaviours of the people (eg. the English v the French). As reported by Johnston (1993, p. 369): "an American medical journalist resident in Europe consulted various physicians about a recurrent medical condition. She found that opinion varied between the American, French, British and German doctors she consulted. She found a diversity in clinical practice which was determined more by national characteristics than by medico-scientific logic. Her research confirmed that cultural factors were a notable influence on interpretation of the medical literature". Even though the differences may be more subtle, similar observations can certainly be made regarding the cultures contained within Asia (eg., Japan v China, Malaysia v Thailand), in spite of the fact that "westerners" commonly refer to an "Asian" culture or way of thinking, and the Middle East (eg., Israel v Syria). It is noteworthy that an area as geographically contiguous as Papua New Guinea is reported to contain people from cultures speaking no less than 717 (45%) of the world's almost 1,600 languages (Lightbody & Wheeler, 1985).

It seems that the formation of national culture may be comparable to the complexity of the determinants of individual personality. While the nature vs nurture debate has been one of ebb and flow over the years, it is most likely that an individual's personality results from a complex interaction of numerous genetic and environmental factors. So too it must be with national culture, which is influenced by genetics, ritual, religion, colonisation, major historical events, immigration, cultural blending, and physical environment factors such as terrain and climate.

Cultures within cultures

Building on this point, it is of course possible to discern cultural differences within **a culture** which, at least from an external point of view, may appear to be relatively homogeneous. The work of Semin and Rubini (1990) illustrates this point rather neatly. They employed a somewhat novel approach to examine the cultural differences between northern and southern Italians, comparing the types of verbal insults used by the two groups. Their hypothesis, that subjects from "more interdependent" Sicily would report a larger proportion of *relational* insults than those from "more independent" Bologna and Trieste was upheld, as can be observed from a selection of the less-graphic insult-types presented in Table 2.

Table 2

A selection of culturally-rooted insults (Adapted from Semin and Rubini, 1990)

Individualist insults (distinctive to northern Italy)	Collectivist insults (distinctive to southern Italy)
<i>You are stupid.</i>	<i>I wish a cancer on you and all your relatives.</i>
<i>You are a cretin.</i>	<i>Your sister is a cow.</i>
<i>Swear-words referring to religious fixtures.</i>	<i>You are queer and so is your father.</i>
<i>Swear-words referring to sexual nouns.</i>	<i>You are a communist.</i>
	<i>Various insults relating to incest</i>

Vocational and work-group cultures

It is also true that certain cultural norms can be associated with those who work in various industries and occupations. As with most vocations, aviation attracts a wide range of personalities from a variety of socio-economic and ethnic backgrounds, yet there are certain cultural norms that are generally shared. Within the aviation industry, there exist a range of sub-cultures which can be labelled as occupational or work group cultures. Examples include the occupations of pilot, flight attendant, maintenance engineer, ramp, air traffic control, etc. While these aviation professions commonly share various vocational norms, there are also significant differences between their sub-cultures. For instance, pilots and flight attendants work together as members of the same flight crew, but there are many differences between them in terms of stereotypical characteristics. The cockpit/cabin crew interface research conducted by Chute and her co-workers at NASA Ames (Chute, Wiener, Dunbar, & Hoang, 1996) analysed the nature of the jobs to reveal some generalised differences in the demographics and roles of the two work groups, and their origins, as depicted in Table 3.

Table 3
Relative crew differences by dimension (Adapted from Chute, Wiener, Dunbar, & Hoang, 1996)

Dimension	Cockpit	Cabin
<i>Gender</i>	Mostly Male	Mostly Female
<i>Age</i>	Mostly 30-60	Mostly 20-40
<i>Workspace</i>	Confined	Spacious
<i>Physical activity</i>	Stationary	Active
<i>Noise level</i>	Relatively quiet	Relatively noisy
<i>Terminal workload</i>	High	Low
<i>Cruise workload</i>	Low	High
<i>Cognitive orientation</i>	Technical	Social

As anyone who has worked within a large organisation with employees based in several different geographical locations will recognise, there may be powerful differences which exist within the one occupational group, between various locations. Airline ramp employees at a large airport base may be very different in terms of their sub-cultural attitudinal and behavioural norms from those at a regional airport, even though they work in the same industry, for the same carrier, in the same job category.

Organisational culture

While national, vocational and work group cultures have an undeniable influence on individual and group behaviour at work, organisational culture has the potential to have a very significant direct impact on the safety performance of organisations. It is organisational culture which ultimately shapes workers' perceptions of safety, the relative importance placed on safety, and members' activities regarding safety (Merritt & Helmreich, 1996a). A number of authors have provided rigorous discussion on the importance of an appropriate organisational safety culture and the role that human factors expertise can play in establishing and maintaining appropriate cultural norms (Johnston, 1991; Lauber, 1994; Maurino, 1994; Pidgeon & O'Leary, 1995; Merritt & Helmreich, 1996a).

The work of Westrum (1993, 1995) provides considerable insight into what we can learn about an organisation from the styles of management it employs. He begins from the premise that "aviation organisations require information flow as much as aircraft require fuel" (1995, p. 75), and moves on to examine three distinct patterns of coping with information used by aviation organisations: *pathological, bureaucratic, and generative*:

The first pattern (pathological) is typical of highly conflicted organisations, where information is treated as a political weapon. The second pattern is familiar from the textbook description of red tape, etc. Organisations that are bureaucratic are good at handling routine situations, but are bad at dealing with change and emergencies. The Generative pattern is typical of 'high reliability' organisations and highly creative ones. In these organisations, personnel assume that they have a licence both to think and to communicate.

Table 4 illustrates the patterns of information flow typical to these three styles of organisation. It may be instructive to take a moment to reflect on the behaviour of your own organisation. When feedback is provided to management detailing operational problems, or better, also suggesting a novel solution to these problems, how does the organisation respond? In a generative organisation the bearers of such tidings are encouraged and in fact may be trained to behave in this manner. In bureaucratic organisations, messengers may be listened to, if red tape does not prevent their arrival, but new solutions are rarely investigated or implemented. In pathological organisations, where denial is commonplace, such messengers are "shot"... Which pattern best fits your organisation?

Table 4
Basic organisation communication styles (adapted Dom Westrum, 1995)

Pathological	Bureaucratic	Generative
Information is personal power	Information is routine	Information is seen as a key resource
Responsibility is shirked	Responsibility is Compartmented	Responsibility is shared
Messengers are shot	Messengers are listened to if they arrive	Messengers are trained
Bridging is discouraged	Bridging is tolerated	Bridging is rewarded
Failure is punished or covered up	Organisation is just and fair	Failure leads to inquiry/learning
New ideas are actively crushed	New ideas present problems	New ideas are welcome

Westrum also contends that organisations do have characteristic responses to evidence of problems or novel ideas, and that these responses can be traced through the stages of the continuum presented below.

Pathological Organisation	Bureaucratic Organisation	Generative Organisation
Suppression > Encapsulation > Public Relations > Local fix > Global fix > Reflective inquiry		

Figure 1
Organisational responses to anomaly (Adapted from Westrum, 1995)

It is not suggested that there is a single organisational culture or corporate style **for all** organisations to aspire to. Just as many different personality types can make good airline pilots, cabin crew, or air traffic controllers, successful organisations within the same industry can be characterised by radically different cultures and operational styles. This becomes apparent when two independently successful companies are brought together by an organisational merger. By way of illustration, when the Japanese banking power houses Dai-Ichi and Nippon Kangyo were merged to form the leviathan Dai-Ichi Kangyo, a team of managers from both sides were assigned the task of developing a 200-word glossary explaining what each bank meant when using exactly the same words (Fisher, 1994). As employees from the two companies began working together they searched their dictionaries like tourists in a foreign land, asking for directions to the nearest toilet (bathroom; restroom)... Not without its parallels is the early 1990's merger of two large Australian airlines, both owned by the same government shareholder, each with admirable service and safety records, but with vastly different organisational cultures and corporate styles.

Safety culture and CRM

John Lauber (1994) has written and spoken at length about the importance of nurturing an appropriate "safety culture" within aviation organisations. A company's safety culture is inextricably linked with, but can be distinguished from its organisational culture. Again, if asked to we can probably all think of organisations, not just airlines, we know which we perceive as examples of good and bad safety cultures. This will depend on factors such as the way in which the organisation handles the often conflicting goals of safety and profitability, the trade-offs between the two, and the level of demonstrated commitment to safety. It also depends heavily on perceptions of the organisational communication styles as detailed by Westrum and noted in Table 4 above. For example, if an employee is concerned about the safety of a certain practice or procedure, are channels open for that concern to be communicated to management. If so, how will management respond? Is the flight safety department proactive or reactive? Are messengers shot?

Also important to the establishment of an appropriate safety culture is the recognition that human error is unavoidable and that it is the responsibility of a mature organisation to effectively manage that error. Reason (1994) sets out a framework to be followed to institute a program of Comprehensive Error Management. Helmreich and Merritt (1996, p. 145) develop Reason's argument to propose that the organisational acceptance of human error (but *not* violations) as ubiquitous and inevitable is a step towards the next (fifth) generation of CRM training:

Using this approach, ...the goals of CRM become a new "troika" - *reducing the likelihood of error, trapping errors before they have an operational effect, and mitigating the consequences of errors when they do occur*. To make this shift requires that organisations formally recognise human fallibility and adopt non-punitive policies regarding everyday error. In essence, this requires normalisation of error within organisations, and acknowledgment of its ubiquity - but not complacent acceptance of its consequences. This places CRM in the context of the system and makes the superordinate goal one of addressing system issues that can foster or reduce error.

Specific behavioural techniques intended to enhance situation awareness and flight safety, such as cross-checking and verification of communication, preparation, planning, and vigilance, speaking up to express concerns, and sharing a mental model of the situation are all means of reducing the likelihood of an error occurring or trapping an error before it has an operational impact. These techniques, along with effective group decision making, and the

recognition that they are not immune to the effects of stress, can equip crews to react effectively to, recover from, and mitigate the consequences of, those errors which may threaten the safety of flight (Helmreich & Merritt, 1996).

While there is still yet some distance to travel, CRM has come a long way since its origins in the early 1980's as cockpit resource management training (see Helmreich, 1993b; Maurino, 1996). Its principles have been extended from the cockpit to other elements of the aviation system (Hayward, 1995a; Merritt & Helmreich, 1996b), have been employed to achieve significant organisational change (see Hayward, 1995b; 1997), and it is now mandated by ICAO for airline flight crews and others (Maurino, 1995). What has been discovered is that culture plays a significant role in determining the response of participants to various styles of CRM training. One size does not fit all, and it is important that CRM training is tailored to fit with the culture - national, organisational, vocational - of the target population.

Enhancing operational safety

- To conclude, several lessons may be extrapolated from the above to provide for the enhancement of operational safety.
- Recognition that the various cultures within which aviation professionals operate do have an impact on their job performance may go a long way toward mitigating the undesirable effects of some of those cultures, and breaking down barriers between sub-cultures.
- Development of a deeper understanding of the causes and consequences of human error can provide management with the foundation from which to launch effective error management strategies.
- Organisational recognition and acknowledgment of the ubiquity and inevitability of human error is the next step in the development of these strategies.
- Development and introduction of non-punitive policies regarding organisational responses to unintentional human error (*not* violations) is an essential component of error management.
- Development and maintenance of an appropriate organisational culture and a positive safety culture is essential and will be supported by the above.
- Human factors training programs must be operationally relevant, and must be targeted towards practical objectives, such as the avoidance, trapping and mitigation of human error.
- If these programs are targeted at such practical operational objectives, their acceptance and success amongst line personnel will be significantly improved.
- While quality CRM training and other modes of applied human factors training are invaluable aids to the reduction of human error, the best place to start an error management program is at the recruiting point.
- This involves the introduction of an appropriately researched and targeted selection system, which is designed to select-in personnel with desired attributes, and selected personnel who will not fit within the requisite safety culture of the organisation.

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²Hofstede's original work involved the mapping of several dimensions of national culture based on data gathered from IBM employees in 66 countries in the late 1960's and early 1970's.

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³Merrin's study was based on data from more than 8,000 male commercial airline pilots, employed by 22 airlines, in 15 countries.

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