ICAO CIRCULAR

CIRCULAR 302-AN/175

2004

HUMAN FACTORS DIGEST No. 16

CROSS-CULTURAL FACTORS IN AVIATION SAFETY

Approved by the Secretary General and published under his authority

INTERNATIONAL CIVIL AVIATION ORGANIZATION
MONTREAL • CANADA

INDICE

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INTRODUCTION

OBJECTIVE

The objective of this digest is to provide the participants in the decision-making process in the aviation industry — including regulatory authorities and airline personnel — with an awareness of cultural interfaces and the impact of cross-cultural factors on aviation safety. While the digest suggests possible avenues of action, it does not however propose solutions, because these solutions will only emerge as consequences of cross-cultural research in operational settings.

AUDIENCE

The digest is aimed at managers of both civil aviation administrations and the airline industry, including airline operational and training managers. The target audience also includes regulatory bodies, safety and investigation agencies and training establishments, as well as senior and middle non-operational airline management.

WHY THIS DIGEST IS IMPORTANT

Cross-cultural interactions are a daily occurrence in international civil aviation, but their real significance to aviation safety is only marginally understood. In the absence of clear understanding, the safety issues underlying cross-cultural interactions are either ignored or incomplete assumptions about their significance are made. Disturbingly, some of these incomplete assumptions are acted upon.

Therefore, the first step is to define and analyse the safety cases potentially underlying cross-cultural interactions and cultural interfaces in international civil aviation; specifically, to identify those areas with the greatest potential to threaten the safety and efficiency of aviation operations. Decision-makers in international civil aviation will find in this digest the basic information to guide them in defining and analysing these safety cases.

SUMMARY OF THE DIGEST

Chapter 1 provides the background on culture, context and cultural interfaces in aviation.

Chapter 2 presents the safety case for cultural interfaces in aviation safety by using the SHEL model, the Reason's model of latent conditions, and the Threat and Error Management (TEM) model.

Chapter 3 discusses the evolution of a dominant model or way of doing things in aviation and highlights both the positive and negative consequences of that dominance with regard to cultural interfaces.

Chapter 4 proposes a way forward through two solutions: a) raise awareness of cultural interfaces and their threat potential among various aviation personnel, including those who shape the dominant model; and

b) collect systematic data in the operating context of different regions around the world in order to quantify the risks posed by different cultural interfaces and to understand local adaptations to the dominant model.

BACKGROUND

Unlike no other technology before or since, aviation is responsible for creating the “global village”. It is now possible to reach any part of the world by air, and to do so in previously unimaginable time. Whereas international travel had previously been a privilege of the wealthy elite or the adventurer, the world today is accessible to more and more people. Business, leisure, even religious pilgrimages are now achieved with the help of air travel. Aviation has changed the way we think about the world and about what is possible in the world.

Civil aviation is the global success that it is today because of its dedication to improving safety. This pursuit of improved standards has advanced the industry in several directions. First and foremost, brilliant minds have created ever more sophisticated machinery — today’s aircraft are extraordinary marvels achieving speeds and load factors never before imagined. A second avenue of improvement has focused on the human being in the aviation system. By placing the human at the centre of the aviation enterprise, the Hawkins’ SHEL model reminded us that people must still handle even the best machinery. Crew Resource Management (CRM) expanded the Human Factors horizon from individuals to teams, while Reason’s model of organizational accidents went one step further to show how policies and activities at the management level can impact safety-related activities throughout an airline, including in the cockpit. This constant dedication to improving safety has led to the examination of cross-cultural factors in aviation safety.

The prevailing approach to the way activities in global aviation are conducted has been shaped in large part by manufacturers of technology and the largest customers. The standards and practices of the industry have been shaped through competitive deregulation, professional interest groups, and resource-rich investment in technology. The outcome of this influence and investment is an outstanding safety record that civil aviation now enjoys. However, despite this overall success, some regions of the world do not enjoy the same high safety record as others, prompting the question “why?” International standards and practices should be equally relevant, equally applied, equally enforced and equally affordable around the world. However, the ICAO Universal Safety Oversight Audit Programme has demonstrated that this is not the case. Regional accident rates vary around the globe, suggesting that the prevailing model of aviation practice may not be equally applicable around the world. Understanding these variable safety statistics more completely was the impetus for this document, since the broadest understanding of those local or contextual factors affecting specific contexts may be the key to further progress in global aviation.

This digest therefore attempts to present the safety case for the consideration of cross-cultural factors in aviation. It does so by focusing not on cultures as such but on cultural interfaces, i.e. those situations where members of one culture encounter people or artefacts from other cultures. To put it in the simplest terms, as long as we stay within the bounds of our own culture, all of the advantages of cultural membership hold: Fellow members and the environment are predictable, thereby making daily routines easier and quicker. But as soon as we encounter members or artefacts (aircraft, procedures, regulations) from other cultures, these cultural efficiencies are challenged and the opposite occurs: The environment becomes less predictable, more uncertain, and requires more cognitive effort. In time and with sufficient exposure, new habits will emerge to deal with the cultural interface. In civil aviation today, cross-cultural contact is the norm rather than the exception. In such a global context, cultural interfaces are a daily reality.

To illustrate the safety case involving cultural interfaces, the digest builds upon three established industry conceptual models. First, the SHEL model introduces the notion of interfaces and notes their relevance for aviation Human Factors. Second, Reason’s model of organizational accidents broadens the Human Factors horizon to include organizational factors that are distant but influential upon the cockpit. The safety case involving cultural interfaces in aviation seeks to broaden the horizon even further, showing how members of one culture can incur confusion, misunderstanding and misapplication when encountering members or artefacts of another culture. In this sense, cultural interfaces hold the potential to become latent conditions. Lastly, the Threat and Error Management (TEM) model provides a framework for "seeing" the cultural interface in the operating context. It can determine which types of cultural interfaces are the most problematic for a specific context; it can also study the threat management strategies employed by aviation personnel to manage these interfaces within specific contexts. Successful solutions can be shared with the industry.

Chapter 1

CULTURE, CONTEXT AND CULTURAL INTERFACES IN AVIATION

INTRODUCTION

1.1 In a broad sense, culture can be defined as the ongoing interaction of a group of people with their environment. The environment shapes the responses of the people, and these responses in turn modify the environment. A culture develops and changes due to three processes: technological and physical changes in the environment; changes in the internal dynamics of the social system; and historical circumstances that are fortuitous or serendipitous (see Figure 1-1).

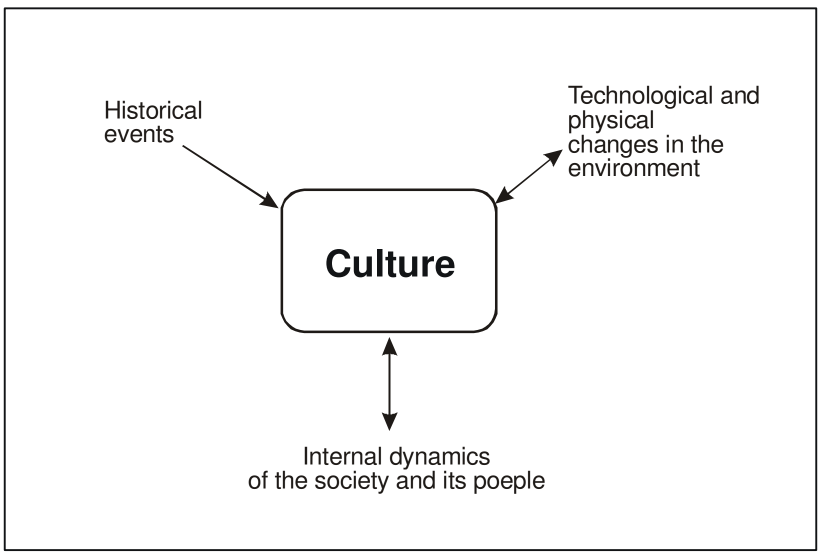


Figure 1-1. How a culture develops and changes

1.2 A simple but significant example of technological change affecting a culture is the invention of the mechanical clock. The first town clock was installed in a town in France in 1314; many public clocks appeared throughout Europe shortly thereafter. Prior to this invention, the concept of time was simple, general and loose. With the widespread use of the mechanical clock, time began to be conceptualized as a succession of measurable units. The "working day" was invented and announced by the bells of the town clock. Similarly, the invention of the aeroplane has been no less profound; it has changed the way people conceptualize the world and their "neighbours".

Culture

A shared system of beliefs (what is true), values (what is important), expectations, and behaviour meanings (what is implied by engaging in a given action) developed by a group over time in order to meet the requirements of living and operating in a particular (geographical) niche.

It is what one expects of oneself and what one expects of others in the groups in which one lives and works.

It is the man-made part of the environment (i.e. machines, buildings, technology).

It is the way we do things around here and how we talk about the way we do things around here (i.e. customs, procedures).

1.3 The longer a group stays together, works together, or shares common goals together, the more its members will discover and share acceptable solutions to common problems with each other. The more the members share solutions, the more they will start to think and act alike. This ongoing adaptation is the basis of culture. This logic holds whether it is a national culture, an organizational culture (of an airline) or a professional culture (among pilots).

1.4 Because a culture is shaped by its environment and evolves in response to changes in that environment, *culture and context are really inseparable*. This rather broad definition is deliberately adopted here to allow for the greatest scope in understanding culture and cross-cultural influences on aviation safety.[1]

CULTURE AND CONTEXT

1.5 There are many layers of context in which a culture is embedded, including the political, the physical, the social and the economic. Figure 1-2 shows the four contexts in which all aviation endeavours occur. Any airline finds itself influenced by these contexts; its daily operations are the solutions to the problems and demands created by these contexts.

Economic and Political Context

1.6 This layer includes several macro-level features, such as:

- national wealth, per capita income, and tax base
- population size and density
- stability of economic and political systems
- laws
- education

1. Anthropologists, psychologists, political scientists and sociologists all differ in their definitions of culture. However, culture is bigger than any one discipline, and much can be learned from accepting all definitions simultaneously.

Together these factors decide the size of the aviation customer base in a country and the general affordability of air travel for people in that country. It also decides the size and stability of government support for the aviation infrastructure. The level of education in a country determines the population's familiarity with technology and their ability to work with it or create their own technology.

Geographic and Physical Context

1.7 Perhaps the easiest to see is the geographic and physical context. The features that define this context include:

- geography and complexity of terrain
- climate and weather
- population dispersion and accessibility

Combined with other factors such as customer demand, these factors decide flight routes and schedules.

Social Context

1.8 The third layer is most closely related to the people and their customs. They include:

- socially agreed upon ways of making sense of the surrounding environment;
- a group's preferred ways of thinking, acting and interacting;
- values or what is considered important; and
- behaviours or what is considered normal.

These features develop over time and are handed down from one generation to the next, evolving into a social system of shared meanings and coordination among members of a culture. These shared understandings make living and working more orderly and predictable.

1.9 The social context is what allows people to manage their daily lives efficiently by providing many short cuts based on familiarity. One needs only to be a tourist in a new land, driving on the opposite side of the road or buying food supplies, to recognize how mentally demanding the unfamiliar can be. Similarly, flying into a new airport or dealing with Air Traffic Control in foreign countries can be very demanding compared with flying in familiar local airspace. Humans function more efficiently within their own social context because generally they know what to expect from others and they know what is expected of them. And usually, as long as we stay within our cultural boundaries, we are correct in our expectations.

1.10 Values — what is important, what is correct — are also shaped within the social context. Values are held so deeply that people may be surprised, shocked, and even offended when they encounter people with values different from their own. Because they are held so deeply and emotionally, values tend to be unquestioned and resistant to change. Some values that drive daily aviation operations throughout the world and which likely differ throughout the world include:

- How fast should be the pace of life and work? How fast is too fast? How slow is too slow? Do we measure a delayed departure in minutes or in hours?

- How important is technology vis-à-vis humans? Who or what has the greater authority, flexibility and “wisdom”? Do we trust the machine or do we trust the person?

- How important are rules and regulations vis-à-vis human discretion? Who or what has the greater authority, the greater “wisdom”?

- What is the acceptable level of safety and related risks? Is one accident per million departures reasonable, given the level of safety in other means of transport and industries? Should it be higher? Should it be lower?

- What is the appropriate way to use and interact with authority? Does everyone have a legitimate voice, or only those with experience and seniority?

1.11 The social context is what people associate most closely with culture because of the customs, norms, values and beliefs. Historically derived and shaped over time in response to environmental demands and changes, the social context is every bit as important as the economic, political and physical contexts in determining how people will act and react.

Airline Operating Context

1.12 The features of the airline operating context are familiar to all aviation personnel. This layer includes:

- the international and local regulations governing aviation traffic;

- the airline’s policies and procedures;

- the aircraft itself;

- manuals and other documentation;

- maintenance and ground equipment;

- Air Traffic Control;

- airports; and

- passengers and their expectations.

1.13 Figure 1-2 shows that this context is impacted by all three other outer layers, namely the economic and political context, the geographic and physical context, and the social context. Yet many of the features in this layer are similar the world over. Airlines tend to fly the same aeroplanes and adhere to the same procedures and regulations despite the fact that they operate in different economic, political, social and physical environments. This is an important point that speaks to the heart of this digest. Why do airlines the world over look at least superficially similar? What are the safety consequences of this apparent similarity? This issue will be discussed at length in Chapter 3.

Conclusion

1.14 To summarize this section, a culture can be considered as the ongoing interaction of a group of people with their environment. It can however be understood more completely by paying attention to the economic, political, geographical and social factors.

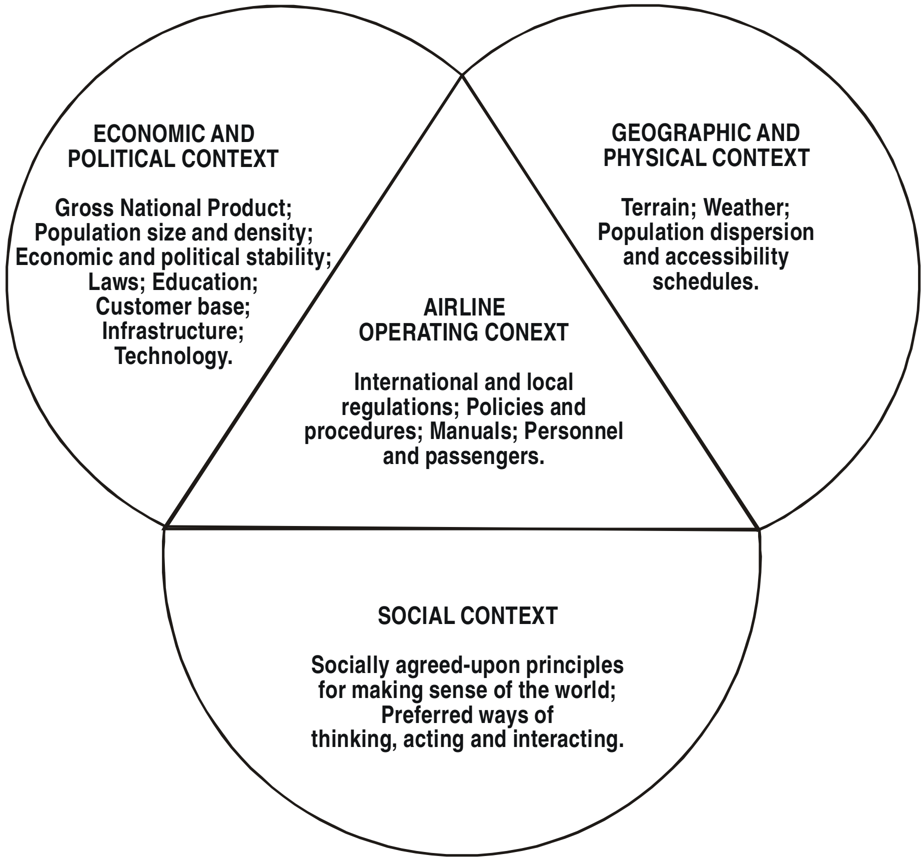


Figure 1-2. Civil aviation in context: A complex system

CULTURAL INTERFACES

1.15 There are many advantages to being a member of a culture. Fellow members and the environment are more predictable, thereby making daily routines easier and quicker. There is security in this knowledge, and this confidence enhances one's efficiency in the culture. But as soon as we encounter members or artefacts from another culture, these cultural efficiencies are challenged and the opposite occurs, i.e. the world becomes less predictable, more uncertain, and requires more mental effort. We need to "think on our feet" to make sense of the surrounding context, rather than taking it effortlessly for granted. In time and with sufficient exposure, new habits emerge to deal with the interface. Understanding new habit formation and its implications in human interactions is at the heart of cross-cultural endeavours.

1.16 By its very nature, aviation is a cross-cultural endeavour. Pilots fly in foreign airspace, transporting passengers and cargos around the world. Even when working within their country of origin, air traffic controllers, aircraft maintenance engineers and other operational personnel utilize technology designed and built in another part of the world. The cultural interfaces in aviation are many and diverse. Table 1-1 provides a non-exhaustive list of these cultural interfaces, highlighting the fact that it is not only when people interact with people, but also when people interact with products of other cultures that uncertainty can be introduced.

Cultural interface

Members of one culture come into contact with members or artefacts of another culture.

Artefact

Any man-made object, e.g. aeroplanes, navigation aids, Standard Operating Procedures (SOPs), training manuals, regulations, others.

Moderating Factors

1.17 There are several factors that foster matches or mismatches at the cultural interface, specifically during daily cross-cultural interactions in aviation. These factors include cultural distance between the interacting cultures, similarities and differences in the resources available to each culture, and the experience of the respective members at the interface.

1.18 Cultural distance explains how some countries can be culturally similar, despite the geographic distance, because of a common language, shared history, similar religion, or political systems, while other geographically close countries remain culturally distant. For example, Australia and the United States are culturally closer than the United States and Mexico. *The greater the cultural distance between two countries, the greater the uncertainty there will be at the cultural interface.* Hence a Chinese regulator trying to understand a (translated) Australian accident report might perhaps experience more uncertainty about its meaning than a Canadian reading the same document.

1.19 A second factor relates to resource similarities in the operating context. To the extent that the social and economic context differs between two cultures, the mismatch at the interface will also be greater. For example, the latest safety advances made possible by technology from the aircraft manufacturer may bemuse a pilot from a developing country, given that the local infrastructure is in no position to support such measures.

1.20 The third factor relates to the social and operational experience of the members of each culture with the interfacing culture. The great talent of humans is their ability to adapt. The more experience there is at the interface, the less challenging the interface will appear to be. *Experience at the interface builds familiarity and reduces uncertainty*. A pilot flying for the first time into a new airport in a distant country experiences the interface more acutely than a pilot who regularly travels in and out of that airport. Pilots flying internationally for multicultural airlines need to develop the necessary familiarity while maintaining a heightened awareness of cultural differences. In operational terms, it is suggested that some established operational practices (e.g. line indoctrination and special airport qualification) may be considered as examples of developing experience at the technical/operational interface. Building experience at the cultural interface is an extension of these successful, established practices.

1.21 With experience and exposure comes adaptation. However, adaptation is mostly based on cosmetic behaviours. It is an accepted fact that cosmetic behaviours crumble under stress and a reversion to native behaviours takes place. The safety case about dealing with cross-cultural interfaces through adaptation is obvious; in stressful situations, adaptation may become ineffective.

Table 1-1. Cross-cultural interactions: A daily occurrence for aviation personnel

Members of Culture 1	*Members and Artefacts o Culture 2*	*Interactions at the interface*
Pilots Flight attendants Engineers Air Traffic Controllers Airline and airport personnel Accident investigators Local regulatory bodies Others	**PEOPLE**	
	Pilots	Multicultural cockpits, airline mergers, alliance/contract pilots
	Air Traffic Controllers	Language exchanges in foreign airspace and with foreign crews
	Flight attendants	Different training, goals and expectations
	Ground personnel	Different priorities; confusion around standards
	Passengers	Different expectations of service
	Trainers	Training in another country on new aircraft or as a cadet
	Investigators	International investigation teams; different legal frameworks
	ARTEFACTS	
	Manuals	Manuals written by personnel in one part of the world are translated or interpreted in other parts of the world
	Aircraft	Equipment specifications that make sense in one part of the world may not be so “logical” in other parts of the world. Maintenance and engineering proficiency as defined and schooled in one part of the world may not be possible in other parts of the world.
	Regulations	Regulations created for a specific economic, political, and social context are interpreted and applied in other parts of the world.
	Legal framework	Different paradigms of accident investigation and accountability; different underlying legal frameworks

Behaviour at the Cultural Interface

1.22 Broadly speaking, there are four possible responses when members of one culture encounter members or artefacts of another culture. These are summarized in Table 1-2.

Table 1-2. Four ways to behave cross-culturally

Option 1: ASSIMILATION	***Option 3: INTEGRATION***
A>B Members of Culture A learn and adopt the ways of Culture B, in whole or in part.	A+B Members of Culture A and Culture B learn each other's ways and compromise.
Option 2: ASSIMILATION	***Option 4: SEPARATION***
B>A Members of Culture B learn and adopt the ways of Culture A, in whole or in part.	A	B Members of Culture A and Culture B ignore each other's ways and do not change.

1.23 The first two options of *Assimilation* are mirror images — either members of Culture A learn and adopt the ways of Culture B, or members of Culture B learn and adopt the ways of Culture A. Both options reflect a willingness or necessity to accept the ways of the other culture. *Even within a single national culture*, as in the case of airline mergers, we see that the smaller airline usually ends up adopting the practices and policies of the larger airline, *even where the smaller airline might have a better way of doing things than the larger airline*.

1.24 A third option for interaction, *Integration*, allows members of Culture A and Culture B to learn something of each other's ways and to find compromises that will be the most effective for that interface. In this approach, two merging airlines might form a pilot's committee to review documentation and procedures and create a new (and improved) set of SOPs suitable for pilots from both airlines.

1.25 The final option, *Separation*, acknowledges that in many cases, members of Culture A and Culture B ignore, by choice or necessity, the ways of the other culture, and maintain their own way of doing business. This model has been observed in some airline mergers, so much so that many years after a merger, some pilots will still identify with their former airline, drawing a distinction between themselves and the pilots of the other "dominant" airline and refusing to fully accept their connection with the other airline.

1.26 Bearing in mind the moderating factors of cultural distance and of resource similarities or differences as well as the motivation arising from the perceived benefits of adopting other cultural practices, the understanding and learning that take place at the interface between two cultures can be of varying quality. The understanding and learning, and subsequent adoption of practices from another culture, can be:

- *Conscious or unconscious*. Members of one culture may not even recognize that they are adopting a different way of doing business, yet they do it nonetheless. Unconscious adaptation can be problematic when the social norms in the two cultures vary because the behaviour may look the same, yet is driven by different underlying logic. As the surprised tourist can attest, a gesture in one country may have a totally different meaning in another.

- *Complete or in part.* Some practices may be easier (and more natural) to adopt than others. In this aspect, it is fundamental to separate intent from style. For example, the need for communication in the cockpit (intent) is appreciated globally, while the "best" form of command authority, as advocated by the Western-developed Crew Resource Management (CRM) (style), differs as a function of leadership preferences in different countries. It is important to preserve the intent, while allowing for flexibility in style.

- *In good faith or otherwise.* There may be a genuine effort to adapt, or in the face of confusion, there may be a superficial effort to adopt the other's way of doing business. The logic of some international regulations may be obscure to some countries, yet they feel compelled to adopt them as is.

- *Successful to varying degrees.* Success is when members of one culture know how to act as if they were natives of the other culture. They understand the organizing principles of the culture sufficiently to predict the behaviour of others in the new culture. In truth, it is very difficult for most people to achieve this level of cultural knowledge and awareness.

SUMMARY

1.27 This chapter introduced the concepts of culture and cultural interfaces. Table 1-1 listed some examples of the confusion that can arise at the operational intersection of two cultures and showed that cross-cultural interactions are a daily occurrence in aviation. The success of these interactions varies according to familiarity and motivation, both of which can be developed through formal organizational interventions. *Because of the potential for confusion, misunderstanding and misapplication, these cultural interfaces deserve closer scrutiny.* The safety case for managing cultural interfaces is presented in the next chapter.

Chapter 2

THE SAFETY CASE FOR CULTURAL INTERFACES IN AVIATION

INTRODUCTION

2.1 This chapter argues the safety case for cultural interfaces in aviation. Hawkins' SHEL model, introduced by ICAO as the conceptual model to explain aviation Human Factors (see *Human Factors Training Manual*, Doc 9683), is used to justify the basic Human Factors case underlying cultural interfaces in aviation. Reason's model of organizational safety, introduced by ICAO to explain systemic safety (see *Human Factors Training Manual*, Doc 9683 and *Human Factors Guidelines for Safety Audits Manual,* Doc 9806), is used to describe, from a systemic viewpoint, how cultural interfaces may potentially become latent conditions in the aviation system which, if not managed, can lead to active failures. Finally, the University of Texas Threat and Error Management (TEM) model, introduced by ICAO to explain the need to monitor normal aviation operations on a routine basis (see *Line Operations Safety Audit (LOSA),* Doc 9803), is proposed as an operational tool used to deal with cultural interfaces, that, as potential threats, must be managed in the same way as other environmental threats.

2.2 An example of potential damage arising from cultural interfaces is illustrated in Figure 2-1 showing four different types of outlet plugs. Suppose a Latin American traveller visits North America. The standard in Latin America is the two-circular pin plug. The North American standard is the two-flat pin plug. The traveller is not aware of the difference. Should the traveller attempt to insert the Latin American plug in the North American system, damage to the equipment will likely ensue. However, there is nothing inherently wrong in either the Latin American or the North American plugs as far as design is concerned. They were designed to be optimally efficient in their respective contexts. There is nothing inherently wrong with the traveller either. The traveller was not aware of a contextual difference. The end result however is that the mismatch at the "operational" interface has all the potential to provoke human error.

2.3 The solutions (e.g. some adapting device for the Latin American pin, training for the traveller, or both) are forms of calibrations or adaptations of a mismatched cultural interface through formal organizational interventions. Simply willing the mismatch away or ignoring it will not make it disappear. This simple example illustrates two important points:

a) the failure of the one-size-fits-all concept, i.e. exporting a solution that is optimal for one context does not mean it will be optimal for other, and

b) the need for formal interventions to deal with mismatches at the cultural interfaces.

THE SHEL MODEL

2.4 The SHEL model[1] (the name being derived from the initial letters of its four components) was the first model in aviation safety to directly address the latent threats at operational interfaces. The

1. The SHEL concept was first developed by Professor Elwyn Edwards in 1972, with a modified diagram to illustrate the model developed by Frank Hawkins in 1975. For a full discussion of the SHEL model, see *Human Factors Training Manual* (Doc 9683) and *Human Factors Guidelines for Safety Audits Manual* (Doc 9806).

interfaces were the interaction of Liveware (humans) with Hardware (machines), Software (procedures, symbology, etc.), other Liveware, and the Environment. The model placed the human at the centre of the four interfaces as shown in Figure 2-2. A quick review of each of these interfaces will show the presence of culture in each of them, hence the image of a globe in each block of the model.

2.5 ***Liveware***. Some of the factors affecting the performance of individuals include physical (the physical capabilities of the individual to perform the required tasks), physiological (those factors that affect the human's internal physical processes), psychological (those factors affecting the psychological preparedness of individuals to meet all the circumstances that might occur during a flight), and psycho-social factors (external factors in the social system of individuals that influence them in their work environments). Though not directly mentioned in the original model, it is reasonable to include cultural factors among other physiological, psychological, and psycho-social factors influencing basic human performance issues such as workload, attention, memory, communication, and so forth.

2.6 ***Liveware-Hardware (L-H)***. The L-H interface looks at how the human interfaces with the physical work environment (e.g. displays to match the sensory and information processing characteristics of the user, controls with proper movement, coding and location). This interface has received the most attention, as researchers and designers struggle to understand how humans will adapt to new technology (e.g. automated aircraft). Given that manufacturers are unlikely to build aircraft for different regions and populations, it is incumbent on them to build the most universally acceptable aircraft — by no means an easy task. The extent to which pilots have been exposed to similar technology previously will affect their ability to adapt. Nonetheless, technology designed with thoughtful consideration of the cross-cultural issues involved in the transfer of technology can go a long way in smoothing the edges of the cross-cultural L-H interface.

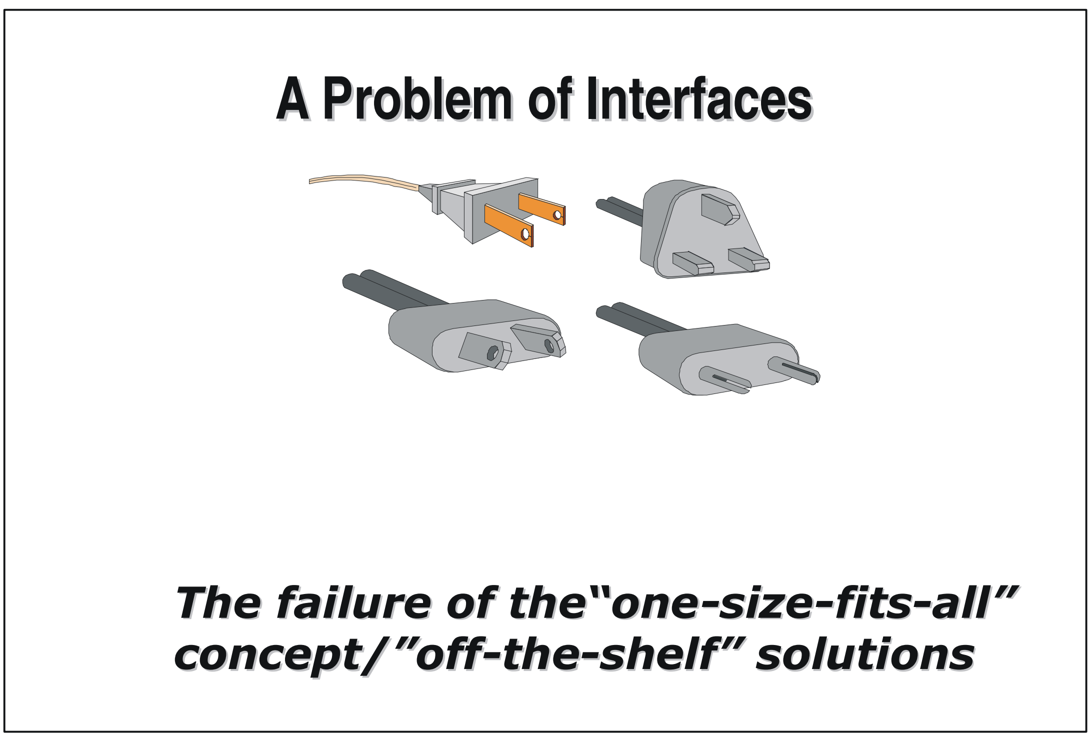


Figure 2-1. Electric outlet plugs: Same purpose, different design

2.7 ***Liveware-Software (L-S)***. The L-S interface is the relationship between the individual and all the supporting systems found in the workplace (e.g. the regulations, manuals, checklists, publications, SOPs, computer software design, and so forth). It includes "user-friendly" cultural issues such as format and presentation, vocabulary, clarity, symbology, etc. Unlike equipment, which cannot be so easily customized, software is an area with potential for manufacturers to work with their customers and produce culturally calibrated documentation to ease the cross-cultural interface.

2.8 ***Liveware-Liveware (L-L)***. The L-L interface is the relationship between the individual and other persons in the workplace. In aviation, the advent of Crew Resource Management (CRM) resulted in considerable focus on this interface, specifically on group performance activities such as leadership, crew cooperation and teamwork. Adding culture to the mix expands the possibilities for confusion and misunderstanding as preferred modes of social behaviour interact across cultures in multicultural cockpits and international flights. As with early aviation Human Factors, this is the interface that so far has been the focus of cross-cultural endeavours.

2.9 ***Liveware-Environment (L-E)***. The L-E interface involves the relationship between the individual and both the internal and external environments. The internal workplace environment includes physical considerations such as temperature, ambient light, noise, vibration, air quality, etc. The external environment (for pilots) includes such elements as visibility, turbulence, terrain, weather, etc. Furthermore, the aviation system operates within a context of broad political and economic constraints, which in turn affect the overall corporate environment. Included here are such factors as the adequacy of physical facilities and supporting infrastructure, the local financial situation, regulatory effectiveness, etc. The contexts discussed in Chapter 1 are clearly involved in this interface.

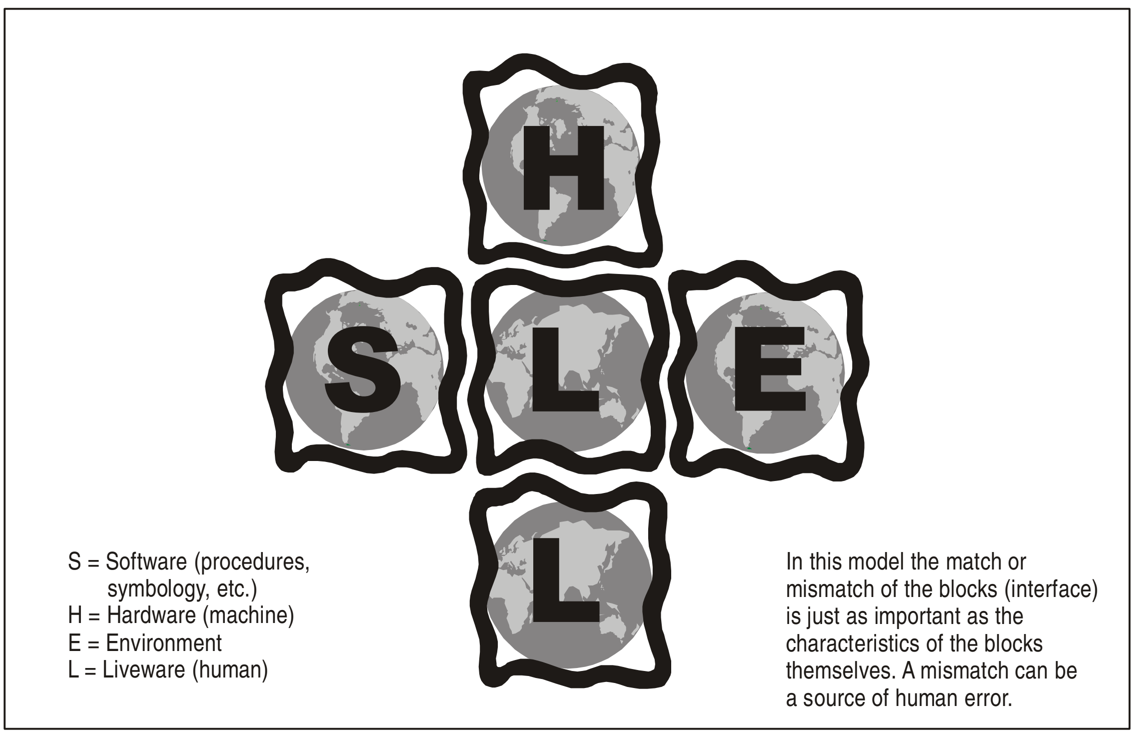


Figure 2-2. The SHEL model of Aviation Interfaces (adapted from Hawkins, 1975)

2.10 To summarize, while culture was not on the Human Factors map back in the 1970s when the SHEL model was first proposed, the idea of interfaces has been with us for 30 years. Extending the model to acknowledge cross-cultural realities is therefore a logical step.

REASON'S MODEL OF LATENT CONDITIONS

2.11 The SHEL model places the human at the centre of the aviation system to emphasize its most critical role. In so doing, it might have inadvertently generated a situation in which individual accountability for any failures in the system might have been overemphasized. Professor James Reason provided a broader perspective on aviation safety (see Figure 2-3).

2.12 Reason explained that it was seldom for an error by one individual operating in isolation to precipitate an accident; typically, several causal and contributing factors converge in time and space to create a situation that is particularly vulnerable to one or more unexpected unsafe acts. Examples of such catastrophes include the accidents at the Three Mile Island (Pennsylvania, United States, 28 March 1979) and Chernobyl (Ukraine, former Soviet Union, 26 April 1986) nuclear power plants, the Challenger space shuttle (Florida, United States, 28 January 1986), and the double B-747 disaster at Tenerife (Canary Islands, Spain, 27 March 1977).

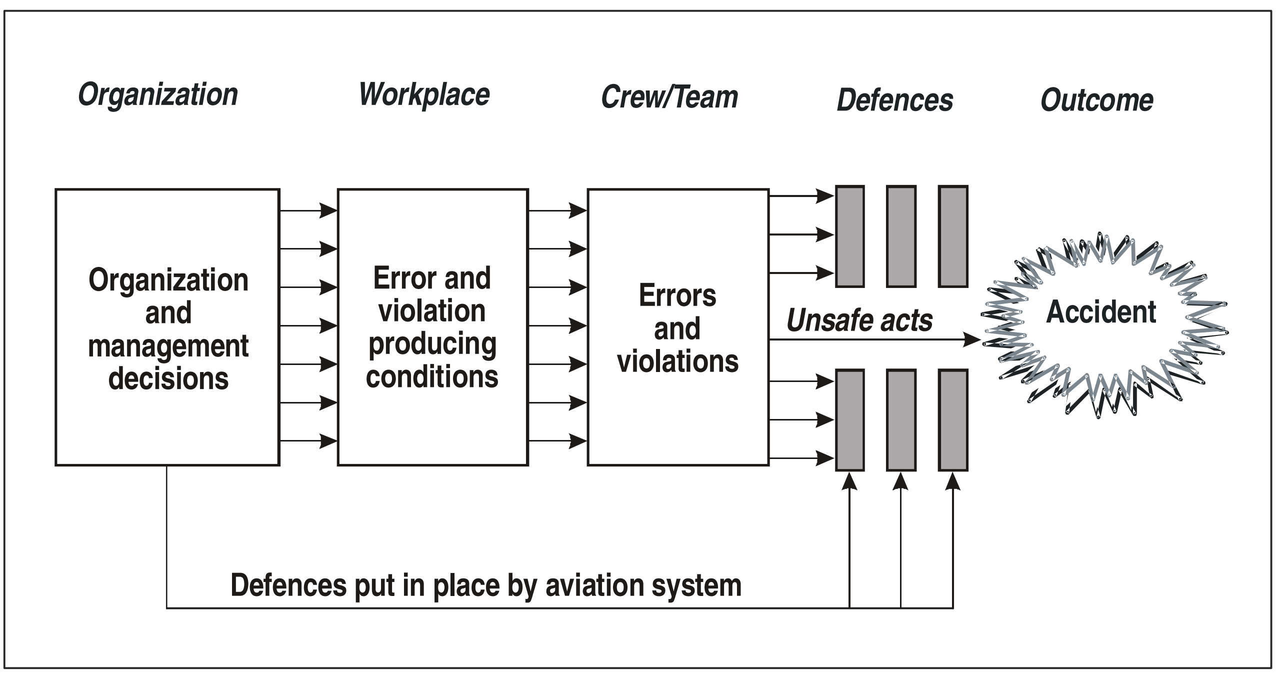


Figure 2-3. Reason's accident causation model
(Source: James Reason, "Collective Mistakes in Aviation:
"The Last Great Frontier" *Flight Deck,* Summer 1992, Issue 4)

2.13 Analyses of major accidents in technological systems have indicated that the preconditions to disasters can be traced back to identifiable systemic deficiencies. It is typical to find a number of undesirable events, all of which likely to contribute to an accident, evolving through an "incubation period" of perhaps years, until a triggering event (such as an abnormal operating condition) precipitates a disaster. Reason referred to these preconditions as latent unsafe conditions (see Figure 2-4).

2.14 Latent unsafe conditions have certain characteristics:

Latent conditions are to technological organizations what resident pathogens are to the human body. Like dormant bodily pathogens which may lead to human diseases, latent organizational conditions may be present for many years before they combine with local circumstances and active failures to penetrate the system's many layers of defence.

- Latent conditions are present in all systems. They are an inevitable part of organizational life where compromises between competing goals (e.g. production versus safety) lead to shortfalls somewhere in the system.

- Unlike active failures, which usually have relatively immediate and short-lived effects, latent conditions can lie dormant for a long time until they interact with local circumstances to defeat the system's defences.

- Latent conditions may only become evident once the system's defences have been breached. They may be present in the system well before an accident and are generally created by decision makers, regulators and other people far removed in time and space from the accident.

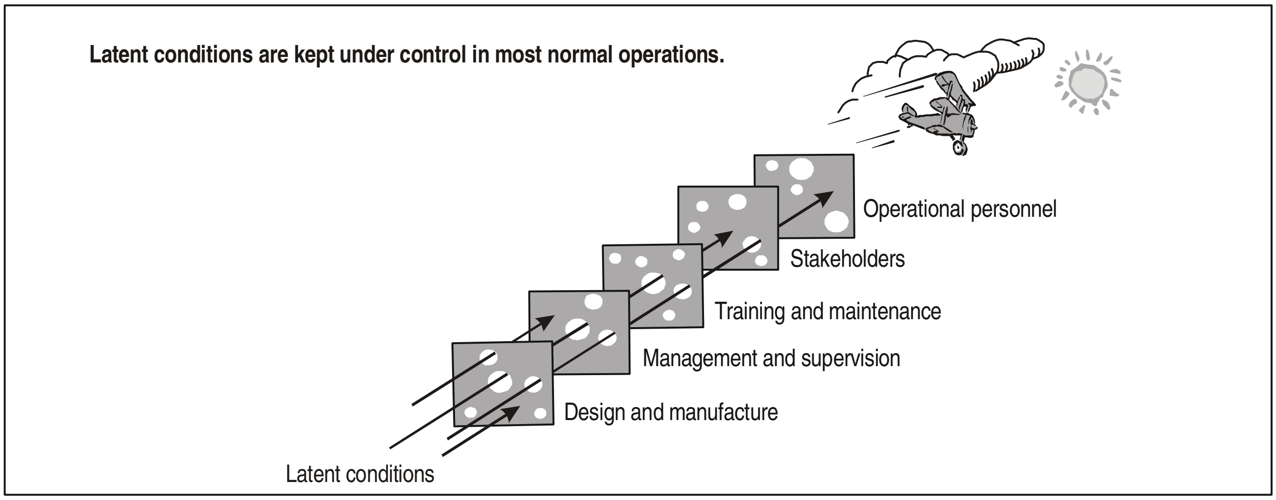
- Latent conditions include poor design, gaps in supervision, unworkable or ambiguous procedures, clumsy automation, shortfalls in training, and less than adequate tools and equipment.

- Latent conditions at the human-machine interface include any defects in the system inherited by the operational personnel, such as those created by poor equipment or task design; competing goals (e.g. on-time service versus safety); defective organization (which may lead to poor internal communications); or management decisions (e.g. deferral of a maintenance item).

2.15 Reason argued that as unsafe acts were often only the proverbial tip of the iceberg, safety efforts should be directed at identifying and mitigating these latent unsafe conditions on a system-wide basis, rather than resorting to localized efforts to minimize unsafe acts by individuals.

2.16 Using Reason's logic, cultural interfaces can be considered a latent condition, unless explicit attention is directed at them. They exist in the system, lying dormant, and operational personnel are expected to manage them. No one claims responsibility for them, yet they may one day foster human errors leading to an active failure. They will foster these human errors by virtue of the uncertainty and potential for misunderstanding that they inject into the system. Otherwise competent professionals may "trip" at a cultural interface at a time when other defences are weak, perhaps when they are under stress, and the results may be disastrous.

2.17 As with other latent conditions, safety efforts should be directed at identifying and mitigating the potential adverse safety consequences of these cultural interfaces if left unchecked. The more these interfaces are actively understood and managed, rather than being allowed to continue unchecked as a pathogen in the system, the smaller are the chances that they will generate human error.



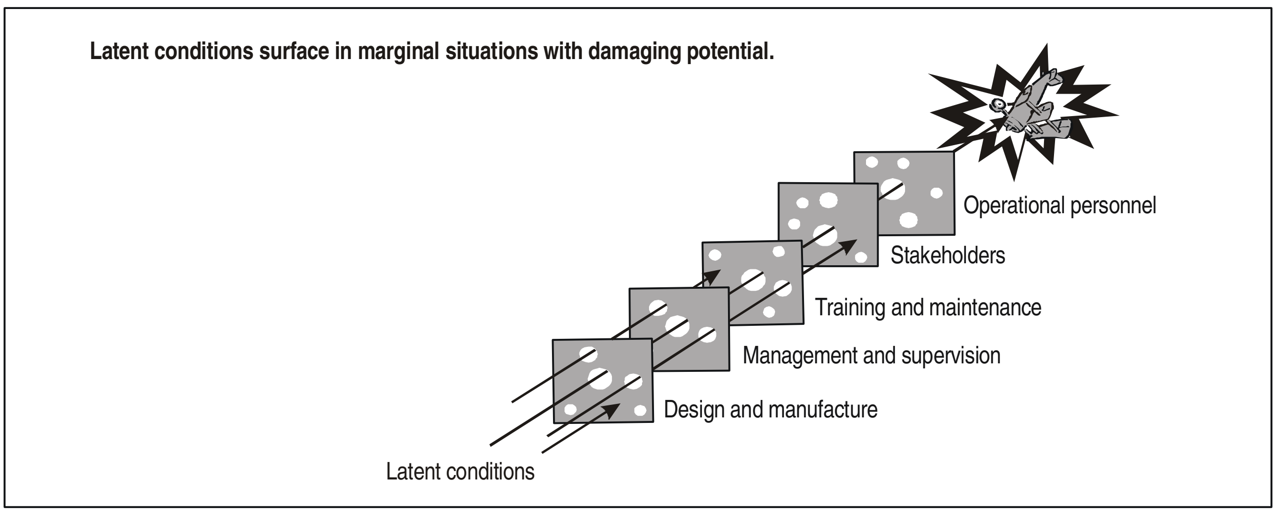


Figure 2-4. Cultural interfaces as latent conditions

CULTURAL INTERFACES AND THE THREAT AND ERROR MANAGEMENT MODEL

2.18 The University of Texas Threat and Error Management (TEM) model (see Figure 2-5) provides a way for translating cultural interfaces from latent conditions into more visible and immediate concerns, as seen in the operating context of an airline. The TEM model, which evolved out of work with Line Operations Safety Audit (LOSA)[2], posits that a typical line flight involves inevitable and mostly inconsequential threats and errors. Some errors are due to flaws in human performance (e.g. selecting wrong frequencies, acknowledging incorrect readbacks, mishandling switches) and others are fostered by external threats such as a late gate change, difficult terrain, a dispatch error, or equipment malfunction.

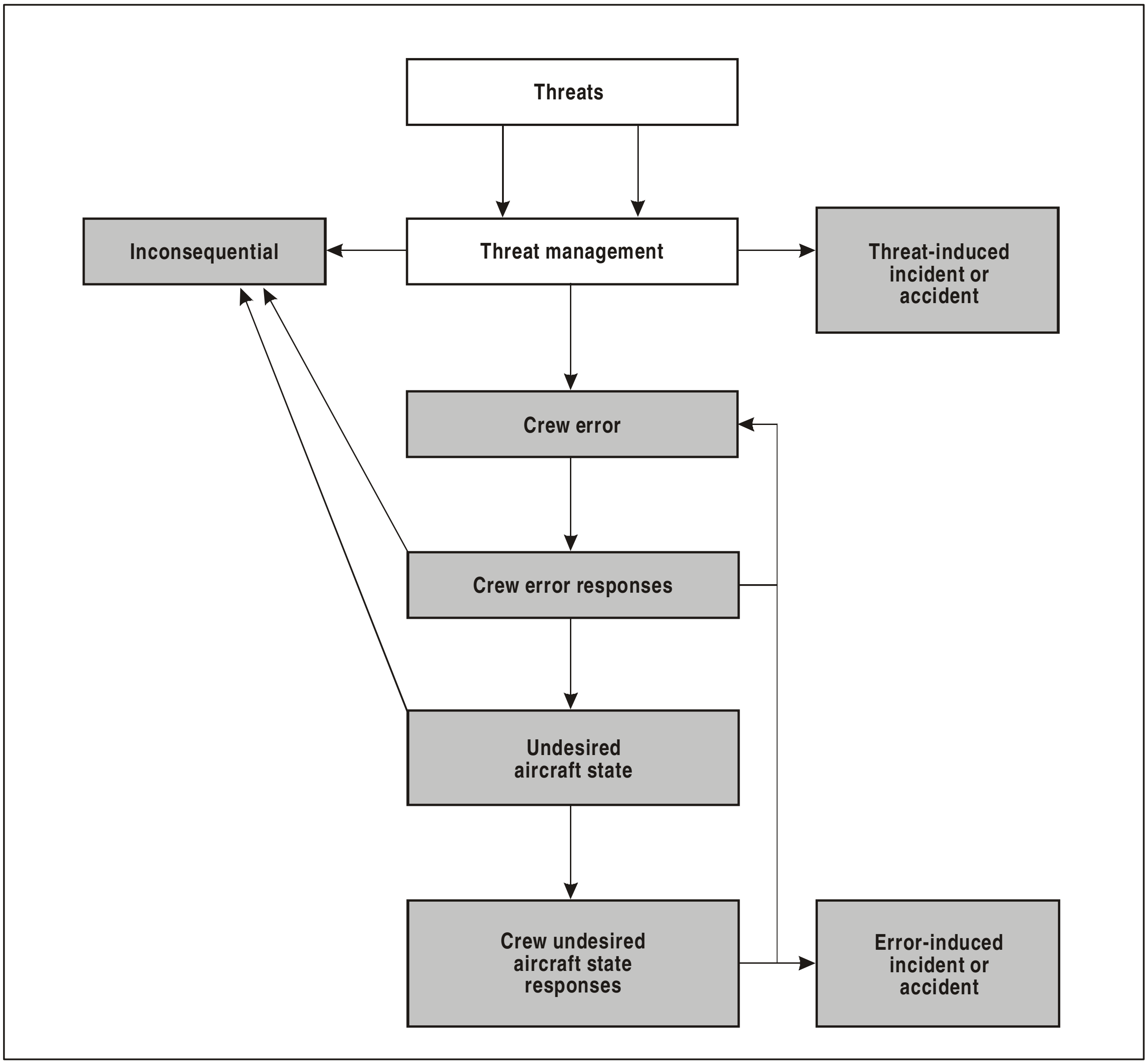


Figure 2-5. Threat and error management (TEM) Model

2. For a full discussion of LOSA, see *Line Operations Safety Audit (LOSA)* (Doc 9803).

Threats

Factors external to the flight crew and which occur outside the influence of the flight crew. Threats increase the operational complexity of the context, and flight crew attention and management are required to maintain adequate safety margins.

2.19 Threats are different from latent conditions in that they are not necessarily deficiencies in the aviation system; rather they are conditions or events that increase the complexity of flight operations and therefore hold the potential to foster error. Threats include environmental threats such as weather, Air Traffic Control, terrain, and airport conditions as well as airline operations threats such as dispatch, cabin, ramp, and maintenance problems (see Figure 2-6). Successful flight depends on successful threat management.

2.20 Cultural interfaces fit the definition of threats in several ways:

- The origin of the cultural interfaces is external to the flight crew.

- Threats can be detected and successfully managed; they can also be ignored, leading to consequential or inconsequential outcomes. This is also the case with cultural interfaces.

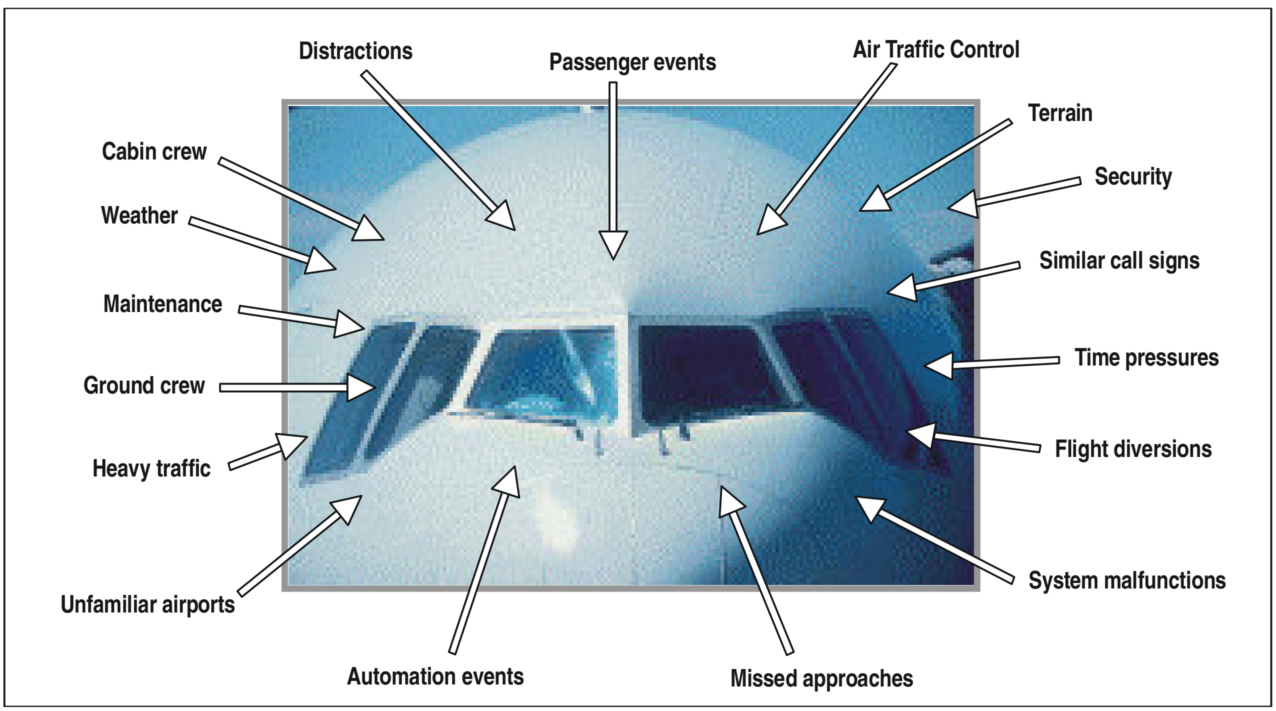


Figure 2-6. Environmental and airline operation threats

- Cultural interfaces are part of the operating environment, as are weather, terrain, airport conditions, and so forth.

- Attention to and management of cultural interfaces, like other threats, are necessary in order to maintain adequate safety margins.

- While not every cultural interface produces a threat, it does contain the *potential* of a threat.

2.21 Viewed from this perspective, cultural interfaces, along with environmental threats and airline operations threats, are an inevitable component of the aviation environment. Acknowledging the existence of cultural interfaces raises awareness of their threat potential — an important first step.

SUMMARY

2.22 Hawkins introduced the notion of interfaces in the 1970s and noted their relevance for aviation Human Factors. Reason brought the model of organizational accidents to aviation in the early 1990s and broadened the Human Factors horizon to include organizational factors that were distant yet influential on the “tip of the arrow,” i.e. the flight deck, the Air Traffic Control room, and the maintenance hangar. Cultural interfaces broaden the horizon even further, showing how members of one culture can incur confusion, misunderstanding and misapplication when encountering members or artefacts of another culture. The TEM model provides a framework for “seeing” the cultural interface in the operating context. Bringing these interfaces to the forefront allows for systematic investigation. This investigation can determine which types of cultural interfaces are the most problematic; it can also study the threat management strategies employed by aviation personnel to manage these interfaces. Successful solutions can be shared with the industry. This idea will be discussed in more detail in Chapter 4.

> The aim is not to eliminate culture or make us all the same. The goal is to recognize and manage the potential threats posed by different cultural interfaces.

Chapter 3

A DOMINANT MODEL IN AVIATION: SOME CONSEQUENCES

3.1 Up to this point, cross-cultural interactions have been presented as the interaction of two relatively equal parties. The members of one group decide the extent to which they want or need to adopt or negotiate the practices of another culture. The reality of global aviation suggests that many interactions are not so balanced, that they are usually weighted in favour of a more dominant group or culture. This chapter explores the evolution of these weighted interfaces and some of the global consequences of such evolution. Manufacturing, standards, research and technology, and the perception of the message delivered by regional accident rates will be discussed.

MANUFACTURING

3.2 The first aeroplane designed to carry fare-paying passengers was built in 1927 — the Ford Trimotor had 12 passenger seats. Boeing built the more advanced and comfortable 247 in 1933, and Douglas Aircraft Company improved upon the concept with the 21-seat DC-3 in 1936, the first aircraft that enabled airlines to make money by carrying passengers rather than cargos.

3.3 The major aviation innovations of World War II — radar and jet engines — occurred in Europe; production was the chief goal of the United States. There were fewer than 300 air transport aircraft in the United States in 1939; by the end of World War II, United States manufacturers were producing 50 000 aeroplanes a year. The three major manufacturers were Douglas, Lockheed and Boeing. Cornering 80 per cent of the commercial aeroplane market, these companies established the United States as the leader of post-war civilian aircraft production.

3.4 A new generation of jet airliners arrived in 1963 using the fuel-saving technology of the turbofan engine. Several models produced in Europe and the United States found popular support in the market: the Boeing 727 and 737, the French Caravelle, the BAC 111, the DC-9, the Fokker F-27 Friendship and the de Havilland Twin Otter. Boeing continued its hold on the market with the 747. Airbus was established in 1970 as a European consortium of French, German and later, Spanish and United Kingdom companies. Airbus' first aircraft, the A300B, was launched at the 1969 Paris air show. Ten years later, the consortium had expanded its family of aircraft to 16, and now Airbus shares the market for new aircraft equally with Boeing. (As Boeing has been established far longer, its aircraft outnumber those of Airbus by a factor of six to one.)

3.5 The conclusion is obvious: Despite the former Soviet Union's formidable aviation industry and the enterprises in countries including Australia, Brazil and Indonesia, the major civil aircraft manufacturers are found in North America and Western Europe. Furthermore, market forces have led countries like Australia, Brazil and Indonesia, as well as other producers of technology, to build their products to conform to North American and Western European certification standards.

MARKETS AND STANDARDS

3.6 The United States government played a pioneering role in the liberalization and deregulation of the global airline industry during the post-World War II era. At the Chicago Convention on

International Civil Aviation in 1944, the United States pushed for "unrestricted international operating rights" in foreign airspace but this was met with intense resistance from European nations, fearful that an open skies regime would lead to domination by United States airlines. However, since the United States was developing as the world's largest and most lucrative air transportation market (see Case Study on the United States as the World's Largest Aviation Customer and Supplier on page 23), European governments were essentially forced into deregulating their airline industries in order to gain access to United States skies.

3.7 Rapid liberalization of the airline industry in the early 1980s resulted in a significant increase in the demand for air transportation between countries, causing intense competition among national carriers for profitable long-haul flights. With airlines from one country now having access to the airspace of another country, national airlines formed multinational airline alliances to strengthen their international position and prevent further encroachment by foreign competitors.

3.8 With almost 70 per cent of the world's aviation departures occurring in either the United States or Western Europe, these regions are in a strong position to influence the standards for international civil aviation operations. The 1944 Chicago *Convention on International Civil Aviation* and its eighteen supporting annexes first formalized these standards. In spite of the multinational nature of ICAO and its harmonized rule-making process, the United States and Western Europe have wielded considerable influence in the development of the rules and regulations of international aviation standards throughout the latter half of the twentieth century. This occurred not only through ICAO but also through other international organizations such as the International Air Transport Association (IATA). However, the most important influence has been wielded through the goods and services (e.g. training, SOPs, safety practices, operational standards, and so forth) prescribed by United States and European aircraft manufacturers such as Boeing, McDonnell, Douglas, Lockheed, Airbus and British Aerospace.

3.9 The conclusion is therefore obvious: North America and Western Europe are the largest markets for aviation. Professional and special interest groups within these countries have influenced global aviation standards.

CASE STUDY: THE UNITED STATES AS THE WORLD'S LARGEST AVIATION CUSTOMER AND SUPPLIER

INTRODUCTION

Based on passenger figures from the year 2000, 42 per cent of all air travel originates in the United States, 24 per cent in Europe, and 23 per cent in the Asia-Pacific region; the remaining 11 per cent originating in diverse locations. The aviation industry in the United States contributes 9 per cent of the country's Gross Domestic Product (GDP), making it the largest industry in the most industrialized nation in the world. To put this number in perspective, the money generated by civil aviation in the United States is larger than the entire GDP of Canada, a country with the eighth largest GDP in the world.[1] How did this situation come about? How did the United States become the largest customer and the largest supplier in global civil aviation? There are several factors that together explain this outcome. Their origins can be traced to three of the contexts discussed in Chapter 1, namely, the socio-economic and political, geographic and physical, and social contexts.

1. The GDP statistics are issued by the International Monetary Fund.

SOCIO-ECONOMIC AND POLITICAL CONTEXT

Population. The population of the United States exceeds 250 million. A large population makes an expensive mass transit system viable.

History. The United States emerged from World War II as the primary supplier of aeroplanes. Within the United States, manufacturers competed by building ever more successful aeroplanes in terms of size, fuel economy, and passenger comfort.

Politics. The United States has enjoyed a stable government system throughout the twentieth century. This has allowed the government structure to grow, stabilize and become predictable in terms of controls and support.

Tax base. A corollary of this political stability has been a relatively high and stable tax system that provides consistent government support for the aviation infrastructure. The tax base also funds aviation research.

Economic system. Capitalism and the belief in a free market economy brought about the deregulation of the aviation industry in 1978. Competition has led to the survival of the strongest, with little sympathy or assistance for those airlines or manufacturers who cannot compete.

Education. In the United States, 90 per cent of the population has gone to secondary school; more than 75 per cent are enrolled in some form of tertiary education. An educated population provides the demand and the human resources for research and development of new technology and products.

Economic resources. The GDP of the United States is the largest in the world, twice that of the next largest country, Japan. High per capita income makes air travel affordable.

GEOGRAPHIC AND PHYSICAL CONTEXT

Geography (within the United States). The United States is a vast country with the majority of the population living on the East and West coasts, making air travel more of a necessity than a luxury. Air travel is the primary means of public transportation between cities in the United States today.

Geography (the world). The United States is separated from most of the world by large oceans. Air travel is the only fast way of reaching other countries.

SOCIAL CONTEXT

Ideas and authority. The United States is characterized as having low power distance relationships relative to many other countries (Hofstede, 1980; 2001). This attribute, combined with a highly educated population and a market-driven economy, results in ideas, especially practical (money-making) ideas, taking precedence over status. Anyone can have a good idea, and ideas propel change.

Pace of life. People in the United States have a more urgent sense of time than people in many other countries. This urgency is well serviced by faster air travel and convenient schedules.

Risk. In a market-driven democracy, the flying public decides the level of acceptable safety. The absence of civil strife, along with ever-improving health statistics such as longevity rates, drives the perception of acceptable risk ever downward.

CONCLUSION

While a similar case might be made for Western Europe as a whole, no other single Western European country has quite the same confluence of history, geography, economy, population, politics and national values. It is therefore not surprising that the United States has emerged as the largest customer *and* the largest supplier of commercial aviation in the world.

RESEARCH AND TECHNOLOGY

3.10 The aviation industry owes its existence to modern technology. Most of this technology have been developed by researchers working in government and industry-funded institutions in politically stable, resource-rich countries such as North America and Western Europe. Like anyone else, these researchers think and work in an environment that is influenced by larger economic, political, cultural and physical concerns. For example, the popularity of air travel in North America and Western Europe has shifted the notion of acceptable risk. As more and more people use airlines as a common and cheap mode of transport, the public has now come to expect air travel to be as uneventful, hassle-free and safe as commuting daily to work in a bus. This demand for safer and safer air transport drives the research for safety enhancement measures. At the same time, the economic context determines what is possible financially and in what form.

3.11 It stands to reason that, as in anywhere else in the world, research is typically undertaken to solve local issues with tools supported by local conditions. In North America and Western Europe, technological solutions are usually expensive, but they are validated and compensated by strong customer demand. These solutions are a good fit for the problems generated in high traffic-density situations that are supported by a strong and stable infrastructure with modern fleets and enforced maintenance and training standards. These characteristics are a reliable part of the operating context in these countries and are part of the researchers' starting assumptions when they begin to form and shape solutions. However, because of the powerful forces behind markets and standards from North America and Western Europe, these solutions are then transferred to other parts of the world where the infrastructure is not equally strong, fleets are older, and training and maintenance are as good as they can be given the local constraints. Different contexts create different priorities and problems. They therefore require different solutions.

3.12 Assumptions about what problems are important and what solutions are viable drive all research efforts. Technology is a cultural artefact because it is driven by:

- what is perceived as a problem in the current environment;
- the suitability of tools that are brought to bear on a problem; and
- the match (or mismatch) between solutions and the most likely users.

3.13 Technology is the product of people solving problems that they identify; hence, the use of technology is less of a problem when it is deployed within the culture of its origin. In such circumstances, the technology may be the perfect alignment of problem, tools and user/customer. But when members of one culture encounter technology created in another culture, the cultural interface may introduce potential mismatches. The mismatch may occur in the definition of the problem, the suitability of the tool or the preferences of the user/customer.

3.14 The conclusion is apparent: Researchers based in North America and Western Europe have developed technology that has led to significant global improvements in aviation safety and efficiency.

However, it is a matter of record that these improvements have not been equal around the world. The generalized perception of regional accident rates is that aviation systems in some regions are less safe than aviation systems in others, a perception that becomes an indictment of the regions with the "less safe" record. An alternative perception, supported by this digest, is that the differences in regional rates reflect the failure of the one-size-fits-all concept, as well as the failure of North American and Western European solutions to provide the optimal safety benefits in regions other than North America, Western Europe and regions with similar resources and cultural match.

GLOBAL CONSEQUENCES OF WEIGHTED INTERFACES

3.15 The preceding sections propose that North America and Western Europe have exerted strong influences on aviation through manufacturing, the size of their markets, and the technological advancements they have funded and developed. As a result, when we talk of cultural interfaces in aviation, most of the time we are talking about aviation personnel encountering aircraft, equipment, training, manuals and standards that are highly influenced by the economic, political and cultural contexts of North America and Western Europe. Some examples of these weighted interfaces are listed in Table 3-1.

3.16 Further evidence of these weighted interfaces may again be found in regional accident rates (see Figure 3-1). In the United States, Australia and Western Europe, the accident rate is less than one accident per 1 million departures. In other parts of the world, the rate varies from two to ten accidents per 1 million departures. There is a negative correlation between accident rates and the extent to which regions

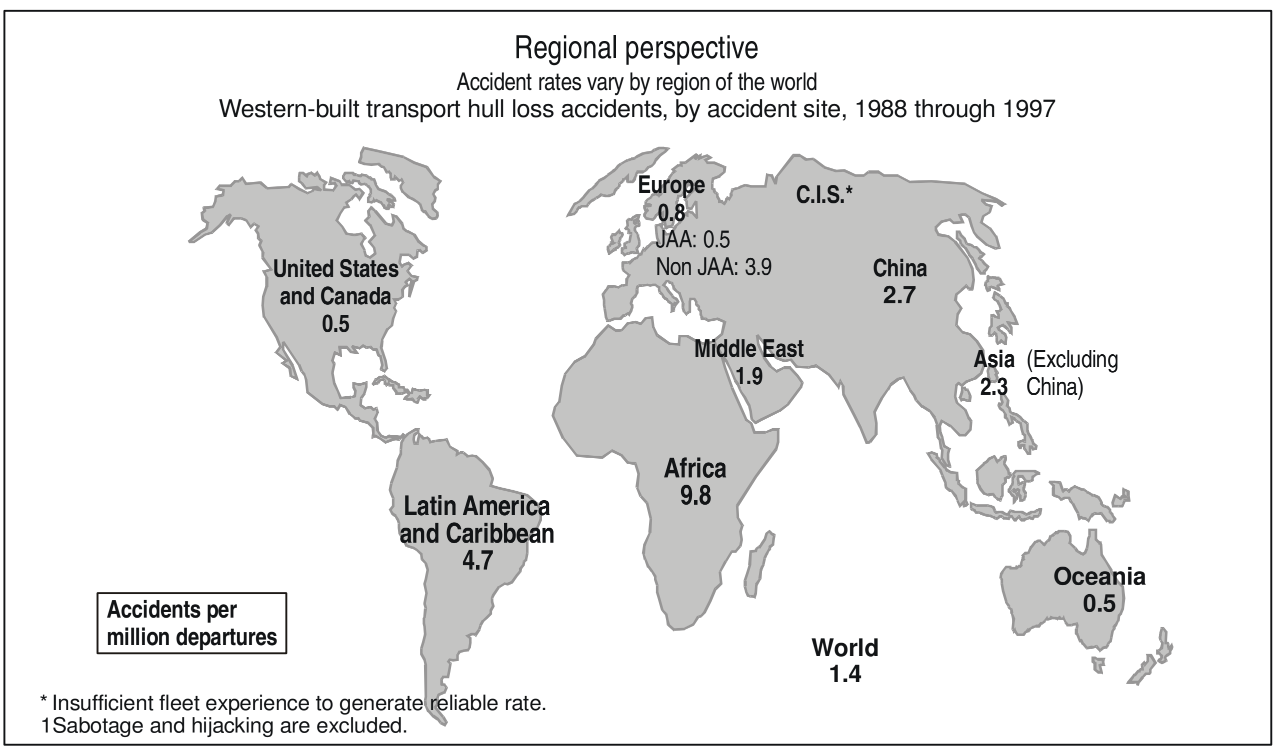


Figure 3-1. Accident rates by region

Table 3-1. Some unintended consequences of the dominant model in aviation

Issues	*Examples*
Identification of problems	Researchers in North America and Western Europe have developed solutions to reduce the accident rate from one per 1 million to one per 10 million departures. In some parts of the world, the accident rate is closer to one accident per 100,000 departures. These regions have different, possibly more essential problems that need to be identified, which affect the allocation of resources.
Solutions	The high technology response to airspace congestion is to install radar, Ground Proximity Warning System (GPWS) and other expensive solutions. In certain parts of the developing world, such solutions are not viable due to a smaller customer base and reduced national wealth. When flight support services are unreliable in this context, low technology solutions (e.g. pilots relying on other pilots in the airspace for updated information) emerge spontaneously. Another example: An international safety group developed a safety tool kit based on extensive research. They translated the product into several languages and copied it on to one efficient compact disc for global distribution. When distribution of the product started, it was realized that pilots in some countries did not have compact disc readers.
Language	The lingua franca of aviation is English. This standard favours pilots in some areas of the world more than others. Nonetheless, all are expected to speak English as the normal way of doing business in international aviation. A software company experimenting with English versus native language computer interfaces discovered that pilots committed more Air Traffic Control readback errors when the interface was English and not their native language. Despite the higher error rate, the pilots still said they preferred the English computer interface, as it was important to them to “be like other pilots”.
Training	Airlines in some countries buy training “off the shelf” from North American and Western European suppliers, often with little or no customization for local conditions. This has been particularly problematic with Crew Resource Management (CRM) training, which is a very culturally influenced tool because of its focus on communication and command authority.
Transfer of technology	In an industrially developing society, new technology must be dealt with in the absence of prior experience in the earlier stages of the technology, because there is no tradition in the use of earlier, related technologies. There can be a significant gap from existing knowledge and skills to those required for successful operation and maintenance of the to-be-implemented new technology. For example, it is easier for a person who has worked with Microsoft Office 95, 98 and 2000 to work with the latest upgrade than it is for a person who has never before worked with Microsoft software. There is also the problem that the originating cultural assumptions implicit in the design of the new technology can clash with the culture of the user.
Regulator	A region imported another country’s civil aviation regulations as the best (and cheapest) way to comply with the international standards. They even used automatic translation. It was not successful because there was no adaptation to the local context. For instance, inspectors are traditionally paid considerably less than airline personnel in this region and it is possible to circumvent the inspectors because of their lower status. The respect accorded to inspectors to do their job in this region is considerably lower than in the culture in which the civil aviation regulations originated.

possess the same economic, political and social contexts as North America and Western Europe. The richer the country, the more politically stable, and the more economically viable air travel is in that region, then the lower is its accident rate. In other words, the closer the fit to the dominant model as influenced by North America and Western Europe, the less consequential the outcomes at the interface appear to be.

INTERACTIONS AT WEIGHTED CULTURAL INTERFACES

3.17 Chapter 1 describes four possible ways to behave at a cultural interface:

a) *Assimilation*, where members of Culture A learn and adopt the ways of Culture B, or

b) conversely, members of Culture B learn and adopt the ways of Culture A;

c) *Integration*, where members of Culture A and Culture B learn each other's ways and compromise; and

d) *Separation*, where members of Culture A and Culture B ignore each other's ways and do not change.

In light of the discussion regarding the dominant influences on many of the interfaces in aviation, the model can be updated as shown in Table 3-2.

3.18 Option 1, *Assimilation,* remains the same as in the model presented in Table 1-2. The more a country shares similar political, economic and social factors with the dominant model as shaped by North America and Western Europe, the better are its chances of fully assimilating into the dominant model and of succeeding. This option has much popular support in the guise of the "one-size-fits-all"-approved practices and regulations. This is an attractive option because the majority of research and technological advancements have been poured into the dominant model. Hence, for those who can assimilate, the safety and productivity benefits are substantial.

Table 3-2. Four options when one culture is more dominant than the other

Option 1: ASSIMILATION	***Option 3: INTEGRATION***
One size fits all Culture A learns and adopts dominant model.	Local solutions Culture A interacts with proponents of Dominant Model to understand and modify approaches.
Option 2: COSMETIC COMPLIANCE	***Option 4: MARGINALIZATION***
Face value Culture A gives the appearance of adopting dominant model.	Isolation Culture A is unable to adopt dominant model; no option.

3.19 Option 2*, Cosmetic Compliance,* acknowledges the unlikelihood that members of the dominant model will assimilate into other cultures. Instead, this option addresses the difficulty of full assimilation. Cosmetic Compliance applies to those cases where members of Culture A want to emulate the dominant model and its practices, but full assimilation is not possible, usually because they do not share the same contextual traits (e.g. infrastructure may be weaker, fleets older, customer base smaller, technicians and civil servants may come from different educational backgrounds). The result is likely to be superficial adherence based on insufficient resources, incomplete understanding, and/or mismatched tools. This option invariably fails under high stress situations, as the more fundamental logic of one's primary culture takes hold and directs behaviour.

3.20 The first two options show the strength and influence of the dominant aviation model as shaped by North America and Western Europe. The majority of airlines around the world have adopted the dominant model, or have tried to, hence the real and apparent similarity observed across airlines. These options support the absolute notion that "an airline is an airline; a pilot is a pilot" regardless of background and that there is therefore no need to address cross-cultural factors in aviation. As stated in 3.18, the advantages of adopting the dominant model are numerous; nonetheless, there are serious safety cases inherent in Cosmetic Compliance.

3.21 Option 4, *Marginalization*, is the result of members of Culture A being unable to assimilate into the dominant model, yet having no substantive alternative. The differences in context and resources are profound enough to make Assimilation virtually impossible. At the same time, a viable alternative is not known. Advocates of the dominant model may offer help, *but the help is nearly always based on the contextual assumptions of the dominant model*, hence the members of Culture A are back where they started, unable to use the "help". The result is groups with lesser performance and higher accident rates as currently seen in some parts of the world.

3.22 The last option to be discussed, *Integration,* offers the greatest hope for successful management of cultural interfaces and of the potential threats they pose. The concern for global safety and the recognition of threats in common airspace is sufficient reason to consider the Integrationist perspective. It requires that members of Culture A be able to identify and articulate the problems they see in trying to adopt the dominant model to their local conditions, and it requires that members of the dominant model consider culturally calibrated modifications to their model. Integration is the only way to develop accurate and efficient solutions to local problems in areas that do not share the same economic and cultural features inherent in the dominant model. ICAO, IATA and other international organizations may play significant mediating roles in this respect.

SUMMARY

3.23 The United States emerged from World War II with the economic resources and mass production capabilities to dominate aircraft manufacturing. Western Europe followed shortly thereafter, and technological innovations in the following decades further strengthened their position as leaders in international civil aviation. With large customer bases and secure infrastructures, these countries were able to research and develop safety enhancement measures that were quickly absorbed into an evolving dominant model. Decades of significant financial investment have sustained and developed the dominant aviation model to such a level that a serious competitive alternative seems unlikely.

3.24 Global aviation is a constant cross-cultural endeavour. However, the emergence of a strongly dominant model has meant that most cultural interfaces, certainly those involving technology, are now weighted in favour of the dominant model and its practices.

3.25 In light of this dominance, the options that promote the greatest global safety are Full Assimilation into the dominant model and Integration of the dominant model with local conditions to produce efficient local solutions. Full Assimilation is possible only when the contextual factors in the receiving model are similar to those found in the dominant model. In reality, some form of Cosmetic Compliance is often the case. Integration offers the best hope for crafting local solutions for local problems; however, it also requires the most effort, as explained in Chapter 4.

Chapter 4
THE WAY FORWARD

INTRODUCTION

4.1 This digest has presented the safety case for cross-cultural factors in aviation by focusing not on cultures so much as on cultural interfaces, i.e. those situations where members of one culture encounter people or artefacts from other cultures. In a global industry such as aviation, interactions at these interfaces are an everyday occurrence.

> Cross-cultural issues in aviation can only be resolved with joint effort. This is not something that "they" (the other cultures) have to fix — there is a role for people on both sides of the interface, for members of the dominant model as well as for people outside the dominant model.

4.2 At this time, there is almost no systematic information available about cultural interfaces. We do not know which interfaces are problematic; nor do we know the extent of successful assimilation or integration in different regions of the world. In order to move forward, two broad and interdependent strategies are suggested.

- The first strategy, the objective of this digest, is to raise awareness of cultural interfaces and their threat potential among various aviation personnel by means of training and analysis.

- The second strategy is to collect systematic data in the operating context of different regions around the world, to quantify the threats posed by different cultural interfaces, and to understand local adaptations to the dominant model.

The specific details of each strategy are described in the following sections.

RAISING AWARENESS: IT TAKES TWO TO TANGO

Training to "See" Culture

4.3 One of the interesting things about culture is that everyone is a member of at least one culture, yet people can rarely explain their culture very clearly to others. The reason is that, like fish unaware of the water in which they swim, people in their own culture tend to be unaware of the principles and values that guide their behaviour (see Figure 4-1). As it is derived historically, culture is handed down from generation to generation as folk wisdom. The trainers teach the cadets, the captains shape the first officers, the "old guys" in the hangar teach the new guys "how things are really done around here" and so forth — the cultural beliefs are thus passed on to the new members.

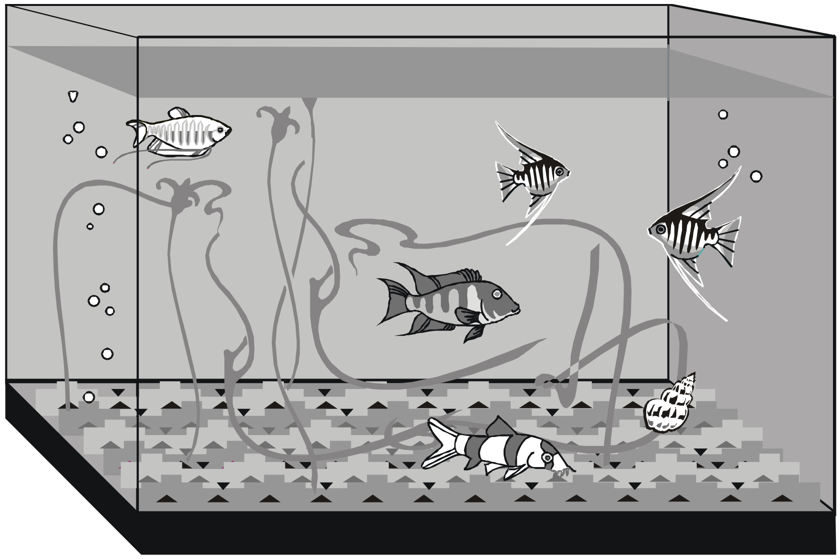


Figure 4-1. Fish in water, people in their culture

4.4 It is natural for people to believe that the culture in which they were socialized is the "way of the world", and that practices and beliefs are similar the world over, i.e. "the same as mine". However, in today's world of global media and global travel, this ethnocentrism cannot be logically sustained. To believe that one's culture is inherently superior to another is either arrogance or ignorance, or both.

4.5 Helping people move beyond their own cultural boundaries to accept other cultures without becoming defensive is something that can be addressed through training, i.e. training to "see" culture. Being able to accept other cultures requires people to look objectively and with some distance at their own culture. Once people can see the strengths and shortfalls in their own culture, they can start to see the pluses and minuses in other cultures. Next, people can then start to see how something that works in their culture may not work in another culture and *for good reason*. The final step is to be able to see how an idea or tool from one culture can be modified to make sense in another culture. This is the end goal, as far as aviation safety is concerned: to see how culturally produced artefacts and procedures can be modified and adapted for other cultures.

4.6 The personnel who could benefit from such training to "see" culture include:

- those who study human performance,
- those who design aviation tools and equipment,
- those who write operational documentation,
- those who train personnel from other countries, and
- those who interact directly with personnel from other countries (e.g. multicultural cockpits, pilots and flight attendants working international flights, and air traffic controllers).

4.7 Training should include a mix of culture-general theories and culture-specific practices. There is research that shows that people from different cultures differ in their preferred way of communicating, interacting, learning, thinking, reasoning and problem solving. These fundamental human processes underlie all design and training issues.

4.8 This type of training to "see" culture is not just for those who want to assimilate into the dominant model. As an example, English is the lingua franca of aviation. Does this mean that only non-native speakers of English must study and perfect their standard English usage? The answer is most definitely "no". The dominant model favours certain nationalities because of the English language requirement. The challenge for these English-speakers is to remove all jargon, jokes, excess words, complex sentence constructions, and non-standard phraseology from their professional communication in order to communicate standard English to those from other linguistic backgrounds. The majority of English-speakers are monolinguists who have never faced the challenge of communicating in a second or third language. English-speaking pilots and English-speaking Air Traffic Controllers need to appreciate the necessity for slow, short, and clearly articulated words, especially if stress or comprehension is an issue.

Analysis to "See" Culture

4.9 Whether one advocates Assimilation ("one size fits all") or Integration (informed local solutions) as the best model of global air safety, the first step is the same — to analyse and explain the underlying logic and intent of the dominant model and its tools. Researchers, designers, manufacturers and regulators need to recognize the assumptions upon which their work is based, and make the logic available for scrutiny by others. The contextual framework introduced in Chapter 1 can be used to explore the factors that influenced the thinking of those who shaped the dominant model.

4.10 Even if advocates of the dominant model ethnocentrically believe that Full Assimilation is the best global solution, they are still obliged to clarify the model, its tools and its assumptions so as to allow for clear and unobstructed adherence. An example of such an analysis can be seen in the case study on Line Operations Safety Audit (LOSA). Notice how the case study focuses on the cultural assumptions and beliefs that underlie LOSA. It does not address other cultures; it simply explains the designers' logic.

4.11 It is incumbent upon aviation personnel outside the dominant model to assess the extent to which conformity with the dominant model is plausible. In order to do that, a contextual analysis of the assumptions underlying the dominant model, similar to the one about the LOSA in the case study but applied to local conditions, would be necessary. These two analyses — an analysis of the assumptions underlying the dominant model and an analysis of the conditions shaping the local environment — could form the basis of an Integrationist dialogue aimed at identifying mismatches in the operating environment regarding problem definition, tools, and/or user/customer preferences.

CASE STUDY: CULTURAL ASSUMPTIONS UNDERLYING LINE OPERATIONS SAFETY AUDIT (LOSA)

LOSA is an aviation safety tool originally developed by the University of Texas at Austin Human Factors Research Project (see *Line Operations Safety Audit (LOSA)*, Doc 9803). Endorsed by ICAO, IFALPA and IATA, LOSA has been used by airlines in the United States, Australia, Asia-Pacific, and Europe. As LOSA becomes better known, airlines inquire about it, trying to evaluate whether it is applicable to their operations. The analysis here attempts to assist airlines decide if LOSA is an appropriate tool for them. The analysis addresses three areas:

a) how the problem was defined for which LOSA was seen as the answer;

b) the tools that were brought to bear on the problem; and

c) the cultural norms and preferences of the participating user/customer.

The analysis is not presented as "proof" that LOSA should be adopted universally; on the contrary, its logic is laid bare to allow interested parties to determine if a LOSA or some modification would be a useful tool in their local environment. It should be noted that many of the factors mentioned regarding United States norms and preferences are also relevant here.

THE PROBLEM IN CONTEXT

Every airline asks itself, "Are we safe enough?" In the past, the answer was determined by looking at accident and incident data. Analysts studied the data, researchers introduced new technology and other solutions to address the perceived problem, assess their effectiveness, and make modifications where necessary. This has led to reduced accidents/incidents (and reduced accident/incident data to analyse).

Still, the public wanted less risk/more safety — a single accident could mean the demise of an airline — and seeking a competitive edge in a market-driven industry, some airlines looked for more sophisticated and more proactive means of improving their safety records, other than accident/incident data. The problem was how to stay ahead of the public's perception of acceptable risk, reduce costs associated with adverse events, and still make a profit. However, for other airlines operating in a less competitive environment, accident/incident containment was enough.

TOOLS TO ADDRESS THE PROBLEM

LOSA is a collaborative effort between a research group of the University of Texas at Austin and several major United States airlines. Cultural biases, both in problem definition and in proposed solutions, are therefore unavoidable. For example, one such culturally fostered belief among the University of Texas researchers (an Anglo-Saxon group), like most North American and Western European scientists, is that "truth" is established through scientific method — a method that proposes you can take a subgroup of the population, and by systematically observing that subgroup, you can draw inferences about the whole group. Statistical analysis of the observations allows probability-based inferences to be made. There is a belief that the scientific method has a purity and lack of bias that makes it superior to individual opinion, regardless of the individual. Rigorous scientific technique ensures unbiased outcomes, i.e. greater truth. The scientific method is one way to acquire knowledge, but it carries many underlying assumptions about empiricism and objectivity; other forms of inquiry acknowledge the inevitability of subjective "truth" and include ethnographic field studies and interviews. The important point is not to prove or disprove such method; it is to acknowledge the fact that such method is underlying LOSA as a cultural artefact.

There is also a strong belief, supported by cultural practices, that data can be confidential in two ways: either they are not shared with other inappropriate parties or the respondent's identity is protected, and that this confidentiality will enhance the unbiased nature of the outcome. It is very common to conduct surveys in the United States and Western Europe based on the promise of confidentiality and anonymity, so much so that respondents accept it as standard and proper practice. This faith in protection against exposure, to a large extent supported by the prevailing legal system, is a fundamental building block of LOSA. However, this faith in protection against exposure is not necessarily the common currency everywhere.

As psychologists, the researchers focus on human rather than machine performance and look at antecedents and consequences of that performance. Being from a United States university, the research group obviously subscribes to United States values. There is very low power distance within the group, and all ideas are welcomed, even from the most junior student upwards. There is also a sense of time urgency and a need for constant innovation and change that propel the group to constantly evolve its research ideas and products. Pragmatism — always asking if something will work or if it will be useful — is a guiding principle that motivates the researchers to constantly test their ideas in the field with end-users. An idea only has value if it can be used. The urge for activity ("doing" more than "being" or "thinking") also motivates constant evolution and testing of tools in the field.

Ongoing funding by the Federal Aviation Administration of the United States has enabled this research evolution. As funding is generated through taxes and allocated annually, there is an assumption that aviation research is valuable and should be funded by the general population. This is part of a greater belief in science and technology as the valid paths to a more valued future. In practical terms, it ensures strategic thinking and long-term commitment, not to mention stability.

As part of the greater community of aviation researchers located in resource-rich, technologically enabled countries, the research group has had ongoing access to new theories and ideas. The concept of error as an inevitable and healthy aspect of human behaviour — first expounded in Western Europe and later exported to the United States — has greatly influenced the group's work. Several years of discussions, conferences, and published papers (in English) have enabled the researchers to advance their ideas in a community of like-minded scientists. The Threat and Error Management (TEM) model discussed in Chapter 2 evolved out of this intellectual context.

In summary, the tools that this LOSA project brought to bear on the problem definition and proposed solutions included empiricism and its belief in "Truth through Data", a focus on human performance, years of research backed by stable funding and enhanced through interaction with like-minded researchers, and a time-urgent pragmatism mixed with a belief in constant improvement.

NORMS AND PREFERENCES OF THE USER/CUSTOMER

LOSA was originally developed with the help of personnel working in large Anglo-Saxon airlines. The potential difficulties for LOSA to travel across cultural frontiers were immediately recognized. As an Anglo-Saxon artefact, many of the features of the LOSA "solution" reflect Anglo-Saxon norms and preferences.

LOSA is defined by ten operating characteristics:

1) Jump seat observations during normal flights

2) Joint management/pilot association sponsorship

3) Voluntary crew participation

4) De-identified, confidential and non-disciplinary data collection

5) Targeted observation instrument

6) Trained and calibrated observers

7) Trusted data collection site

8) Data cleaning round tables

9) Targets for enhancement

10) Feedback results to the line pilots

An examination of these LOSA operating characteristics reveals several cultural assumptions and beliefs.

a) First, there is a strong reliance on empiricism and the scientific method (see items 4, 5, 6, 7 and 8).

b) Second, there is also a strong egalitarianism and sense of low power distance that place pilots, unions and management on equal footing for the purposes of items 2, 3 and 10.

c) Third, item 9 presupposes that the reason for conducting LOSA is a desire to improve (not simply to get a "check").

d) Fourth, item 1, on which all of LOSA is predicated, presupposes that pilots will allow a confidential, anonymous and objective observation of their performance. To establish this credibility with the pilots, the proposed solution requires that pilots observe pilots. They may be retired pilots, first officers, training captains or line pilots; nonetheless, the airline must be prepared to pay these people to observe others working. As such, LOSA can be affordable for resource-rich airlines, but expensive for others.

LOSA was developed in response to a problem defined by airlines operating within the dominant model, and it was shaped to suit the preferences of the users, namely, airlines operating within the dominant model. While the basic underlying problem — operational errors — is universal to all airlines, some airlines will need to decide:

- If the problem addressed by LOSA is of a magnitude that is relevant to them and if it has the same priority as other safety concerns in their local environment. For the airlines, resources might be more effectively applied elsewhere in the system to improve safety; there may not be the same level of social demand for safety; and there may not be a market-driven, competitive need for improvement.
- Whether the empirical data-driven tools brought to bear on the problem would be logical and acceptable to pilots and management in their local context.
- If, or how, they would need to modify the tools in any way to make it more acceptable to their pilots or management.
- The University of Texas researchers endorse the Integrationist approach of local solutions for local problems. As such, airlines are expected to enter into a dialogue with the research group about how LOSA might be modified to meet their different needs.

4.12 In summary, raising awareness of cultural interfaces through training and analysis is an essential step towards recognizing and managing these cultural interfaces. Those who shape the dominant model as well as those who try to adapt it need to have this awareness.

DATA-DRIVEN RESEARCH

4.13 Another way to focus attention on cultural interfaces is through data-driven research. Focusing on cultural interfaces rather than cultures allows cultures to be taken out of the people's mind and put into the operating context where they can be studied dispassionately and with operational focus. Cultural interfaces deserve a place on the aviation safety research agenda.

TEM – A Methodology for Investigating Cultural Interfaces

4.14 The University of Texas Threat and Error Management (TEM) model (see Figure 2-5) divides the operating context into a) environmental and airline operating threats, b) error, c) undesired aircraft states, and d) their respective management patterns. Cultural interfaces fit the definition of a threat and can be incorporated into the model. Jump seat observations during normal operations (the LOSA methodology) will proactively identify problematic interfaces and their management. They will also identify those interfaces that are not problematic, and most importantly, they will identify successful local adaptation and integration strategies to manage problematic interfaces. Crew interviews will further the understanding of these interfaces.

4.15 For example, it may become apparent from flying in certain parts of the world that certain procedures are unworkable, that communication with Air Traffic Controller is problematic due to accents or equipment, that constraints make some maintenance activities unviable at some stations, that navigation aids are unreliable, that weather notifications are based on outdated or incomplete data, that passengers are likely to carry hazardous materials, and so forth. Most importantly, it will make evident how operational personnel utilize the features and resources in the context as local countermeasures against these problems, thereby completing successful operations.

4.16 Culture and cultural interfaces, while interesting in and of themselves from an anthropological perspective, are only interesting in aviation inasmuch as they impact safety. Thus, *tying cultural interfaces to their management in the operating context is the bottom line*. Manufacturers, legislative bodies, individual airlines, airline alliances, and cross-cultural teams of researchers could conduct the research. “Seeing” some of the interfaces may be initially as challenging as “seeing” one’s own culture objectively, hence the presence of one or more cultural mediators on the research team would be a great advantage.

CULTURAL MEDIATORS: AN INDISPENSABLE COMPONENT

4.17 Some people are more suited to understanding cultural interfaces than others. Of particular importance are those people who have lived and worked effectively in two or more cultures and are able to explain the practices and logic of one culture to members of another culture in a way that makes sense to both sides. *These cultural mediators act as bridges between cultures.* Such people exist in aviation coincidentally, but more are needed. To that end, the design of programmes to specifically develop more cultural mediators is suggested as a solution. These programmes, in the form of internships and exchange programmes, may be introduced within airlines, airline alliances, research institutions, civil aviation authorities, accident investigation services, and manufacturers. There are existing programmes similar to those advocated here, but they are initiatives of specific organizations rather than a concentrated, industry-wide endeavour. Making cultural interfaces an explicit (not implicit), often discussed topic would be part of these programmes. Some interfaces need to be challenged, and that will only come with increased confidence and understanding on both sides. Hence, any programmes, exchanges or internships that would accelerate the number of cultural mediators in aviation would be very welcome.

SUMMARY AND CONCLUSION

4.18 Cultural interfaces will always be a part of global aviation. The challenge for safety is not to attempt to eliminate differences at these interfaces but to manage the potential threats they might pose. Systematic research of the interfaces in different regions around the world will uncover strengths and weaknesses in the global system. These successes and failures will focus future efforts to improve the interface. To move forward, there is a role for those inside and outside the dominant model.

4.19 The role of advocates and insiders of the dominant model:

- Continue to advance safety in the industry by utilizing all resource-rich advantages;
- Recognize that inevitable cultural boundaries surround many solutions and advances;
- Recognize that Full Assimilation into the dominant model is not always possible due to contextual differences;
- Accept Integration and Adaptation as valid safety strategies and open the door for Integration (ideas from outside the dominant culture) as a way to build a stronger global industry;
- Support systematic research of cultural interfaces in different operating contexts;
- Establish programmes that develop cultural mediators (e.g. internships and exchange programmes);
- Enlist cultural mediators in the development of tools, policies and procedures;
- Encourage manufacturers to work with their customers at the level of SOPs to differentiate style from intent, particularly through clear statements of the assumptions and objectives underlying particular design decisions; and
- Provide awareness training for those who operate at cultural interfaces.

4.20 The role of cultural groups outside the dominant model:

- Recognize contextual differences with the dominant model;
- Acknowledge constraints in complying with external standards;
- Articulate local problems and mismatches with the dominant model;
- Recognize the cultural boundedness of some solutions advanced by the dominant model;
- Encourage and support systematic research of cultural interfaces in the operating context;
- Encourage personnel to become cultural mediators;
- Develop the knowledge and confidence to challenge the dominant model;
- Develop the knowledge and confidence to advance local solutions; and
- Provide awareness training for those who operate at cultural interfaces.

4.21 As the first and greatest of all global industries, it is time for aviation to acknowledge cross-cultural factors in aviation safety. With combined effort, this important safety challenge can be confronted, investigated and managed.

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— END —

ICAO TECHNICAL PUBLICATIONS

The following summary gives the status, and also describes in general terms the contents of the various series of technical publications issued by the International Civil Aviation Organization. It does not include specialized publications that do not fall specifically within one of the series, such as the Aeronautical Chart Catalogue *or the* Meteorological Tables for International Air Navigation.

International Standards and Recommended Practices are adopted by the Council in accordance with Articles 54, 37 and 90 of the Convention on International Civil Aviation and are designated, for convenience, as Annexes to the Convention. The uniform application by Contracting States of the specifications contained in the International Standards is recognized as necessary for the safety or regularity of international air navigation while the uniform application of the specifications in the Recommended Practices is regarded as desirable in the interest of safety, regularity or efficiency of international air navigation. Knowledge of any differences between the national regulations or practices of a State and those established by an International Standard is essential to the safety or regularity of international air navigation. In the event of non-compliance with an International Standard, a State has, in fact, an obligation, under Article 38 of the Convention, to notify the Council of any differences. Knowledge of differences from Recommended Practices may also be important for the safety of air navigation and, although the Convention does not impose any obligation with regard thereto, the Council has invited Contracting States to notify such differences in addition to those relating to International Standards.

Procedures for Air Navigation Services (PANS) are approved by the Council for worldwide application. They contain, for the most part, operating procedures regarded as not yet having attained a sufficient degree of maturity for adoption as International Standards and Recommended Practices, as well as material of a more permanent character which is considered too detailed for incorporation in an Annex, or is susceptible to frequent amendment, for which the processes of the Convention would be too cumbersome.

Regional Supplementary Procedures (SUPPS) have a status similar to that of PANS in that they are approved by the Council, but only for application in the respective regions. They are prepared in consolidated form, since certain of the procedures apply to overlapping regions or are common to two or more regions.

The following publications are prepared by authority of the Secretary General in accordance with the principles and policies approved by the Council.

Technical Manuals provide guidance and information in amplification of the International Standards, Recommended Practices and PANS, the implementation of which they are designed to facilitate.

Air Navigation Plans detail requirements for facilities and services for international air navigation in the respective ICAO Air Navigation Regions. They are prepared on the authority of the Secretary General on the basis of recommendations of regional air navigation meetings and of the Council action thereon. The plans are amended periodically to reflect changes in requirements and in the status of implementation of the recommended facilities and services.

ICAO Circulars make available specialized information of interest to Contracting States. This includes studies on technical subjects.

1/04, E/P1/1600
ISSN 1729-1097
Order No. CIR302
Printed in ICAO
ISBN 92-9194-227-8