

ACHIEVING AIRWORTHINESS THROUGH CULTURE

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Abstract:

Just as an aircraft needs all its systems to operate safely, similarly an organisation needs all elements of its culture to operate cohesively in order to perform efficiently. If the organisation culture of an airline is not strong and cohesive, it cannot hope to reach the continuing airworthiness standards demanded of today's Air Operators Certificate (AOC) holders. In 2010 Australia's domestic airlines made 581,900 aircraft trips and carried 53,920,000 passengers (Report on Domestic airline activity December 2010. BITRE); the smaller Air Operators Certificate (AOC) holders flew 1.3 million hours in 2009 (AOC Safety Questionnaire 2010. CASA).

Using data drawn from reports on surveillance of continuing airworthiness management practices by domestic airline operators prepared by the Australian Civil Aviation Safety Authority (CASA) over the last 12mths, this paper explores the relationship between organisational culture and the success of some airlines in achieving the required level of continuing airworthiness standards. The paper examines and analyses airline airworthiness measures and three organisational culture attributes; strategy, airworthiness objectives and continuing airworthiness vision, and the results from the analysis also provide valuable lessons for operators in the general aviation, regional airlines and military aviation sectors. The authors argue that the strength of an operator's strategic focus on airworthiness and the prevalent cultural profile of the operator, together act as a predictor of the success of that operator in achieving espoused goals and objectives related to continuing airworthiness management.

A discussion of the implications of this research for the governance of continuing airworthiness programs is also presented.

Key words: Continuing airworthiness, program governance, and organisational culture.

1 INTRODUCTION

Continuing airworthiness management "...is the processes that requires aircraft to comply with the airworthiness requirements in their type certification basis or imposed as part of the State of Registry's requirements and are in a condition of safe operation, at any time during their operating life" (ICAO Airworthiness Manual Doc 9760, page 102.Chapter 4). Aviation accident data shows that twenty two (22) percent of all fatal accidents in aviation are due to aircraft mechanical failures (PlaneCrashInfo.com). Ultimately it is the responsibility of the registered operator to ensure that their aircraft remain in a condition of safe operation, and this is done by effectively managing the continuing airworthiness activities associated with aviation safety.

Professor Edgar Schein (1992, page 12) defines organisational culture as " a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think and feel in relation to those problems". Guldenmund (page 251, 2000) performed an extensive review of literature on safety culture and concluded that "in the way Schein conceives and defines (organisational) culture, there is no need for a specific definition (of organisational culture) for safety". Taking a more specific focus on the safety culture itself, Guldenmund provided the following definition; "those aspects of the organisational culture which will impact on attitudes and behaviour related to increasing or decreasing risk."

There is a large body of previous research to confirm the general hypothesis that organisational culture impacts on the effectiveness of companies and the success of an operation or project. Specific research has confirmed that organisational values and beliefs will impact performance (Deal and Kennedy, 1982), and that by taking a more holistic perspective on culture that includes strategic fit and adaptability a more complete description of the relationship between the organisational culture and performance can be developed (Kotter and Heskett, 1992; Denison and Neale, 1996). Other researchers seeking to leverage the work of these early researchers have gone on to confirm more specific relationships between elements of culture, such as involvement of staff, and more definitive performance measures such as quality (Coffey, 2010, Coffey and Willar, 2010). Researchers in the project and program management domain have also proven relationships between organisational culture and short term performance (Gordon, 1992), the task orientation of the culture and budget performance (Andersen, 2003).

The outcomes from an effective airline continuing airworthiness management program make a key contribution to the overall aviation safety of their aircraft. Safety culture researcher, James Reason (1997), studying the commercial aviation industry identified the main organisational traits that affect a safety culture. In summary:

- These cultures are adaptive, taking a proactive approach to risk management and change. Staff share safety information, and the results from its analysis.
- Trust is high, working together is acknowledged as the way to solve problems and staff feel empowered to manage whatever problem they encounter. Core values define acceptable and unacceptable behaviours.
- The adaptive culture helps anticipate issues and risks and the ability to draw the right conclusions from the safety information is linked to better performance.
- A good strategic fit of the culture enables goals, objectives and structures to be adjusted to suit a dynamic business environment
- Strong reporting culture, guided by consistent values, is held throughout all the levels of the organisation

Reason's work has been instrumental in creating an understanding in the aviation industry that unsafe cultures create potential pathways to failure and eventually cause organisational accidents, (Reason, page 293, 1998). With this research groundwork on aviation safety culture laid down by Reason, others have looked at ways to measure the total airline safety by using indices that essentially indicate an airline's overall safety level across the breadth of its operations; flight operations, continuing airworthiness, maintenance, ground handling and the cabin (Chang, Y.H. and C.-H. Yeh 2004). Other branches of aviation safety research have sought to provide greater qualification and definition of the safety culture aspects and build frameworks to provide a better understanding about different levels of a safety culture (Parker, D. Lawrie, M. Hudson, P. 2005). However, very little research has been done on the strength of organisational culture and safety performance specifically looking at the achievement of continuing airworthiness management outcomes.

This paper looks at the key organisational culture traits associated with strategic fit and adaptability, with specific attention to the relationship of the strength of the strategic fit of the organisational culture associated with the management of continuing airworthiness and the success of operators in achieving espoused goals and objectives related to continuing airworthiness management.

1.1 The Australian Continuing Airworthiness environment

With effect 27 June 2011 CASA started to implement a new set of safety outcome based regulations which move accountability for managing the continuing airworthiness of operator's aircraft away from CASA approved individuals, Head of Aircraft Airworthiness and Maintenance Control, to an organisational accountability for the registered operator. This is a fundamental change which requires the operator to provide governance of all the continuing airworthiness management activities for its aircraft.

Three safety outcomes can be derived from the ICAO (Airworthiness Manual Doc 9760) definition of continuing airworthiness management;

- All operating aircraft must comply with the airworthiness requirements of their type certificates
- All aircraft must, at any time during their operating life, remain in a condition of safe operation
- All operators must comply with their National Airworthiness Authority's regulatory requirements

At the highest level within the new CASA maintenance rules "Continuing airworthiness requirements for aircraft and aeronautical products" (CASR Part 42, 42.030, dated 8 December 2010), the registered operator must ensure that all the requirements of the continuing airworthiness management tasks are met for all their aircraft. The major activities to be controlled when managing the continuing airworthiness of aircraft focus on the registered owner's obligations to set the standards for the maintenance of their aircraft, ensure that the maintenance meets the set standards, have an effective maintenance program, the review of that program and, maintain accurate

maintenance records (EASA Part M, CASR Part 42G, 8 December 2010).

1.1.1 Continuing airworthiness management tasks

Many National Airworthiness Authorities (NAAs), including CASA, have identified detailed tasks or processes to be completed by the operator when managing an aircraft's continuing airworthiness. The applicable tasks for Australian operators are covered in CASR Part 42, Division 42.C.2 dated 8 December 2010:

- Rectification of defects to aircraft before flight
- Compliance with airworthiness directives
- Approval of design for modification or repair to aircraft
- Dealing with certain instructions for continuing airworthiness
- Replacement of life limited aeronautical products
- Manage approved maintenance program
- Compliance with maintenance program
- Updating maintenance program after changes from instructions for continuing airworthiness
- Ensuring effectiveness of maintenance program
- Removal of parts fitted, without authorised release certificate, under special provisions of CASR 42.440 dated 8 December 2010

1.1.2 Governing continuing airworthiness

“Governance involves a set of relationships between a company’s management, its board, its shareholders and other stakeholders. Corporate governance also provides the structure through which the objectives of the company are set, and the means of attaining those objectives and monitoring performance as determined.” (OECD, 2004) By just controlling these continuing airworthiness management processes does an operator have enough assurance that the goals implied in the ICAO definition of continuing airworthiness are being met? Behn (2003) notes that when evaluating effectiveness of organisations or systems, the best measures are focused on outcomes rather than outputs, but he continues (ibid 2003) that when evaluating the task performance then process efficiency measures are more applicable. Governance of safety for aircraft needs a balanced set of strategic measures that address the outcomes of both the business and those of ICAO and the relevant NAA.

Simplistically, there are two governance models relevant to Australian airlines and these are shareholder and stakeholder models. In reality organisations do not sit at either end of these concepts but instead exhibit preferences towards one of the models (Muller, 2009). The Shareholder model assumes that the main purpose of the airline is maximising the shareholder returns, typically measured by earnings before interest and tax (EBIT) and net profit. This requires a governance structure that assures managerial action is in the best interests of the shareholder. This approach places priority on the shareholders interest at the expense of other stakeholders, and focuses organisation attention towards a single bottom line (Clarke, 2004)

Alternatively the stakeholder model assumes that the airline’s objectives are a balance of potentially conflicting interests from different stakeholders; shareholders, staff, customers, regulators and, suppliers. Advocates of this approach claim it provides a more sustainable performance over the shareholder model (Clarke, 2004)

At opposite ends of the spectrum are process and outcomes focused organisations and the reality is that most companies will tend towards one of these organisational types. Process focused organisations aim to achieve business outcomes by driving consistency of the processes, whilst outcomes focused organisations will drive the business outcomes through core skills and high levels of involvement by key staff (Hofstede, 2005; Muller, 2009).

On Time Performance (OTP) is the most common performance measure used by HCRPT operators to measure the effectiveness of their operations (Fry, 2004). The outcome, OTP, is measured as the number of flights operating on time as a percentage of the number of flights operated on any particular sector. The measure is published by the Australian Bureau of Infrastructure, Transport and Regional Economics and compares operators’ performance. Alternatively, Fry also highlights that many airlines employ a balanced set of measures focussing on financial, operational and safety performance. This later group of airlines are embracing a stakeholder type of governance.

1.1.3 Continuing airworthiness management performance

In the face of increasing competition within the industry, airlines have adopted a variety of performance measurement techniques to help monitor the operational, safety and financial aspects of performance. Research conducted by Jackie Fry was based upon survey responses from 200 of the world’s largest airlines and concluded that performance measurement became more critical to airline management when they were faced with increased financial and operational pressures (Fry, 2004). While the airlines will predominantly focus upon operational and financial performance measurement, safety performance measurement in aviation is explicitly covered by an airline’s Safety Management System (SMS) where the monitoring and measurement of selected operational

activities are required by many NAAs to ensure aviation safety. In these systems, long term safety performance targets and short term safety performance indicators are established, and safety performance and outcomes are regularly reviewed by airlines (CASA, CAAP SMS-1, 2009). The SMS targets and indicators are set by each airline and the continuing airworthiness of airline aircraft is implicit in the safety goals of an airline's SMS.

Neely (2007, pages 141-162) describes a performance measurement framework that links inputs, processing systems, outputs, outcomes and goals. This framework is a useful way of describing the relationship between an airline SMS targets and indicators and the continuing airworthiness tasks performed by an airline. Figure 1 below is a performance measurement framework for governing continuing airworthiness management.

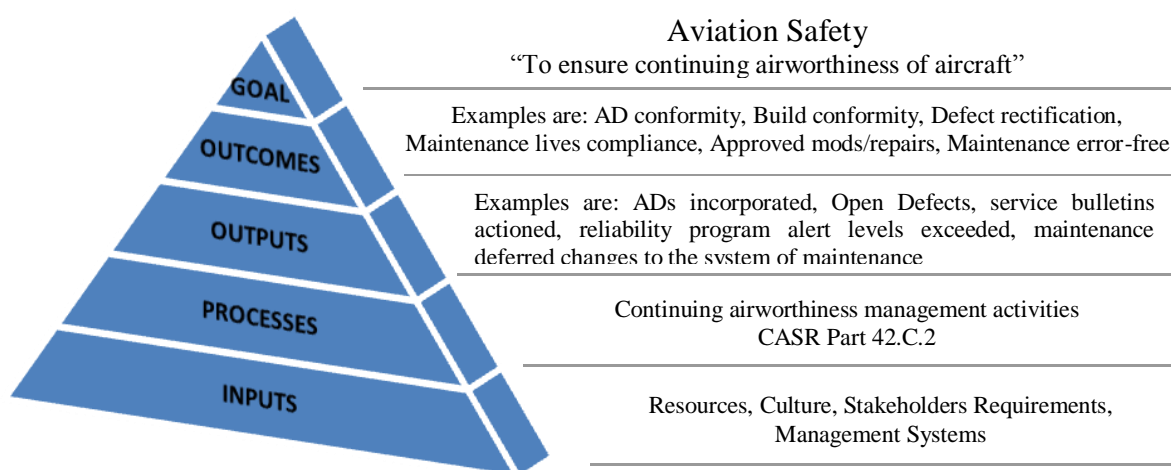


Figure 1: Continuing Airworthiness Performance Management Model

Continuing airworthiness regulations focus on defining the requirements (i.e. inputs) or in some cases tasks or processes that must be accomplished when managing continuing airworthiness. Within an organisation responsible for managing continuing airworthiness, the direct effects of these day to day activities or processes must be controlled and can be driven by measuring certain outputs from these processes; airworthiness directives incorporated, open defects, service bulletins actioned, reliability program alert levels exceeded, maintenance tasks deferred, percentage remaining of maintenance lives, and changes to the system of maintenance are all examples of output measures that could be employed by operators. These outputs all have an impact on the achievement of the continuing airworthiness goals; aircraft that are safe to operate and comply with their type certificates and regulatory requirements. This flow of value adding activity moving from inputs to outcomes all contribute to the safety goal of aviation safety.

1.2 The desired culture of continuing airworthiness management organisation

The registered operators of aircraft have to ensure safety outcomes; that their aircraft are in a condition of safe operation at any time during their operating life, that their aircraft comply with their Type Certificates, and regulatory compliance. Within the Australian culture, it can be reasonably expected that organisational cultural strength (homogeneity) is significantly related to outcome focussed organisations and their effectiveness. (Peters & Waterman, 1982. Hofstede, page 293, 2005). In discussing organisational leadership, Ken Blanchard (2006) identifies that effective organisations help staff focus on their work and the accomplishment of outcomes for their customers. The leadership in these outcome focussed organisations ensure the following practices and behaviours;

- *Clear vision, goals and objectives* – Identifying general end-results toward which effort is directed (goals); specific, measurable targets along the way (objectives); and performance measures that assess progress toward these goals and objectives
- *Standardization of outputs* – Coordination is obtained by the clarification of expected results. The individual actions required to obtain a goal are not prescribed
- *Sharing of information* – involves potentially sensitive information on safety being available to employees
- *Empowered staff* – Formal and informal means of sharing decision making, power and influence between leaders and subordinates
- *On-going learning* – Experimenting, learning from small & large deviations from expected outcomes.

Supporting Blanchard’s views on leadership, Denison’s research demonstrated that effective organisations have high culture scores in four traits; Mission, Consistency, Involvement, Adaptability. Thus, effective organisations are likely to have cultures that are change-ready and learning organisations, yet highly consistent and predictable, and that foster high involvement, but do so within the context of a shared sense of mission (Denison, 2006).

This paper started by briefly discussing organisational culture and governance of continuing airworthiness management activities. The next section of this paper examines the hypothesis that the degree of ‘homogeneity’ of strategic focus on airworthiness leads to superior performance in the management of continuing airworthiness. The paper addresses two issues: (a) The organisational culture of a sample of the airline staff involved in continuing airworthiness activities and, (b) the measurement of continuing airworthiness management outcomes. The relationship between the organisational culture and governance of continuing airworthiness is then discussed along with opportunities for industry improvements.

2 METHOD AND RESULTS DISCUSSION

From June 2010 to June 2011, data on airline organisational culture and continuing airworthiness management performance was collected by CASA. The organisational culture data was gathered using a survey questionnaire based upon a modified Denison organisational culture model. Using a Cronbach alpha analysis of this survey data the reliability of the modified culture model was successfully validated. Secondly, the continuing airworthiness management performance data was collected from the airlines by CASA using outcome effectiveness measures developed through a series of workshops. These data were then examined to test the levels of dependency between the culture and continuing airworthiness management performance.

2.1 Measuring Airline continuing airworthiness management culture

Denison’s research linked the strength of an organisation’s culture and the subsequent financial performance. “The Denison model of organisational culture highlights four key traits (Mission, Consistency, Involvement, and Adaptability) that an organization should master in order to be effective. Each trait breaks down into three more specific indices for a total of 12 indices.” (Denison, pages 1-2, 2006).

In order to better measure the organisational culture associated with staff responsible for continuing airworthiness management activities, the Denison model was modified to specifically address the business context; realising aviation safety outcomes within a program of continuing airworthiness management activities and projects. The modified model retained the same four key cultural traits and similar culture indices as the 12 used in the Denison model. The Denison model has 60 questions, and the modified model retained 50% of the questions unaltered. The changed questions were tailored to be more specific that the airline was the organisation and that the goals and activities related to the management of continuing airworthiness. 12 new questions were included that asked respondents to rate the importance of the four Key Cultural Traits in achieving the continuing airworthiness goals for the airline. The modified framework is outlined below in Table 1.

Key Cultural Traits	Cultural Indices
Strategic Fit	Strategic Intent & Direction
	Airworthiness Goals & Objectives
	Vision for Continuing Airworthiness Management
Consistency	Core Values
	Agreement
	Coordination across airline
Involvement	Empowerment
	Teamwork
	Capability of staff
Adaptability	Change Management
	Regulatory Focus
	Learning

Table 1: Modified cultural assessment framework for continuing airworthiness management

2.2 Culture model for airlines surveyed

There were 182 survey respondents that answered the 72 questions. While the cultural framework (Table 1) used was based around the Denison model, half of the original questions had been modified and 12 new questions added. Using the 182 survey returns to test the reliability of the modified model, a Cronbach alpha analysis was conducted for each of the cultural indices, Table 1. This analysis measured the internal consistency of the set of 5 questions being used to test each specific cultural index, and provide confidence that the questions were measuring a common cultural attribute. It is generally accepted that Cronbach alpha results of > 0.70 is considered acceptable and results > 0.80 indicate good levels of internal consistency (George & Mallery, 2003). The results from this analysis provide evidence that the modified cultural model questions were appropriate for measuring the described Cultural Indices in Table 1. The results from this analysis are outlined below in Table 2.

Cultural Indices	Cronbach alpha
Strategic Intent & Direction	0.83
Airworthiness Goals & Objectives	0.80
Vision for Continuing Airworthiness Management	0.82
Core Values	0.73
Agreement	0.73
Coordination across airline	0.78
Empowerment	0.73
Teamwork	0.81
Capability of staff	0.75
Change Management	0.77
Regulatory Focus	.070
Learning	0.74

Table 2: Modified cultural assessment framework Cronbach alpha results

Over a 12 month period, the 182 individuals involved in continuing airworthiness management activities were surveyed. The results from these surveys are presented in Figure 2, and while they do not represent the entire Australian domestic airline industry, they do provide an overview of emerging continuing airworthiness management strengths and weaknesses within the industry. The survey used a 1-5 scale; 1= Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree.



Figure 2: Overall culture model (N=182)

For the group of surveyed individuals, Figure 2, the strong cultural indices are; staff empowerment, the continuing airworthiness strategic intent and direction of the airline, and the regulatory focus of the airline. The relative weak indices of the organisational culture are; the vision for the continuing airworthiness management organisation (CAMO) and coordinating work within the airlines. Further discussion of these results is provided later in this paper.

Figure 3 shows for each of the cultural indices, the normalised result for each surveyed operator; the results are relative to the importance of the key cultural traits as scored by respondents and calculated using Equation 1 below. The surveyed operators had greatest differences in their ratings in the cultural indices of; the continuing airworthiness goals and objectives for the airline, the vision for CAMO, regulatory focus, and change management. Hence, the greatest cultural differences between the operators surveyed are in the areas of their strategic fit with their business environments, and their ability to anticipate and adapt to changes. The Key Culture Traits of consistency and Involvement did not show significant variations in the scores between the operators.

$$\text{Equation 1: } CI = \frac{\text{Culture Index Rating}}{\text{Importance Rating}}$$

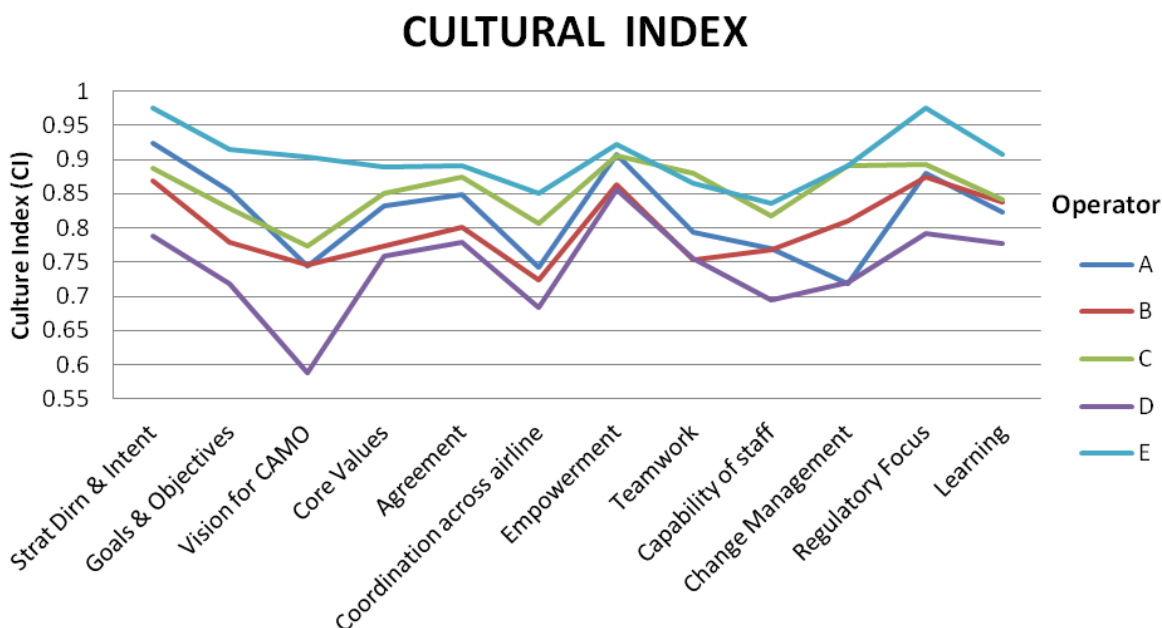


Figure 3: Cultural Index Ratings

Specifically looking at the two Key Cultural Traits with the greatest variance in scores the Strategic Fit and Adaptability, along with their constituent culture indices, Table 3 provides the details of each operator’s individual scores. These scores were tested for both correlation and dependency with the continuing airworthiness management performance for each operator surveyed.

Organisational Culture		Operator A	Operator B	Operator C	Operator D	Operator E
Organisation Culture Index	Strategic Intent & Direction	0.924	0.869	0.888	0.788	0.975
	Airworthiness Objectives	0.855	0.778	0.828	0.718	0.916
	Vision for the Continuing Airworthiness Management	0.744	0.746	0.774	0.587	0.904
Key Cultural Trait	Strategic Fit	0.841	0.798	0.830	0.698	0.931
Organisation Culture Index	Change Management	0.719	0.81	0.891	0.721	0.892
	Regulatory Focus	0.88	0.874	0.893	0.792	0.976
	Learning	0.822	0.838	0.841	0.778	0.908
Key Cultural Trait	Adaptability	0.807	0.841	0.875	0.764	0.925

Table 3: Cultural Traits with greatest performance difference between operators

2.2.1 Cultural Indices description

Strategic Intent and Direction describes the long term plans and direction of airworthiness and safety, whereas Airworthiness Goals & Objectives establishes the level of understanding of the continuing airworthiness goals and objectives within the organisation, along with the level of knowledge about the airlines performance against those goals. The third index in the Strategic Fit cultural trait group, Vision for the Continuing Airworthiness Management, poses questions to establish the ability of the organisation to meet day-to-day needs of the business and still maintain a long term viewpoint when making decisions.

The second cultural trait group to be further analysed in conjunction with the continuing airworthiness management performance is Adaptability. This group includes the indices measuring the airline's ability to manage change, the focus on the regulatory agencies, and finally the ability to achieve organisational learning to anticipate potential risks and issues.

2.3 Measuring continuing airworthiness management performance

Today, customers and airline boards can easily evaluate the reliability of an airlines planned flights using performance measures such as On-Time-Performance. The same is not true for evaluating the effectiveness of an airlines continuing airworthiness management, the safety of its aircraft.

To holistically govern the performance of an operator's continuing airworthiness management systems, monitoring and measurement needs to occur continuously with focus on inputs, processes, outputs, and outcomes. To answer whether an airline's continuing airworthiness management activities were effective, performance measurement against the outcomes or SMS targets is needed. Measurement of outcomes not only helps quantify success but also provides data for monitoring past performance and helps planning future performance, in essence providing control feedback as well as information needed for future change.

Continuing airworthiness management outcome measures were produced during a series of workshops with subject matter experts from CASA and industry. The final list identifies measures for evaluating the effectiveness of continuing airworthiness management but does not identify efficiency measures that would also be required by an operator seeking to develop a balanced set of business performance measures. The research question is related to the success of operators in achieving the continuing airworthiness standards, and hence the use of effectiveness measures is appropriate for this analysis. The continuing airworthiness management outcome measures are as follows:

1. The number of flights where an aircraft has operated, for any reason, without complying with a requirement of an Airworthiness Directive
2. The number of flights where an aircraft has operated, for any reason, with an incorrect part fitted
3. The number of flights where an aircraft operated, for any reason, with unapproved repair or modification
4. The number of flights where an aircraft has operated, for any reason, with an incorrect configuration for the intended level of operation
5. The number of flights where an aircraft has operated, for any reason, with a life expired component
6. The number of flights where an aircraft has operated, for any reason, where the MEL was incorrectly applied or expired
7. The number of flights where an aircraft has operated, for any reason, with a defect or damage beyond approved limits published in aircraft manuals
8. The number of flights where an aircraft has operated, for any reason, with a maintenance over-run
9. The number of flights where aircraft operated with a maintenance error undetected

2.4 Analysis of organisational culture and continuing airworthiness management performance

The continuing airworthiness management outcome measures identified at 2.3 were provided to CASA by the surveyed operators, and then compared with the Table 3 results for Key Cultural Traits of Strategic Fit and Adaptability. Performing a correlation analysis between the Key Cultural Traits and the total continuing airworthiness outcome measure for each operator identified that only one group of cultural indices had a good correlation with the airline airworthiness performance. While the culture traits of Adaptability, Consistency and Involvement returned low correlation factors (r) of 0.37, 0.41, and 0.37 respectively, the Strategic Fit culture trait

scores showed good correlation ($r = 0.72$) with the operators' continuing airworthiness outcome measures.

A further regression analysis performed for the Strategic Fit culture trait results and outcome performance measures identified that; variations in the Strategic Fit culture trait could account for approximately half of the performance differences seen between the continuing airworthiness management outcomes from the surveyed operators. Continuing airworthiness outcome performance did not show any significant dependency with any of the other Key Cultural Traits. The significance of these relationships and their implications for the governance of continuing airworthiness will be discussed in the next section.

3 CONCLUSION

Governance is the corporate activity which sets the strategic framework, and in doing so establishes the goals and objectives that determine the focus and themes for the organisation. Many organisations like to keep the strategic framework tightly aligned to business performance, focusing on a small number of financial and operational goals (refer to figure 1). With the introduction of outcome based aviation safety regulations, the operators of aircraft are encouraged to adopt more of a stakeholder approach to governance, an approach that requires safety goals to be held in balance with the financial and operational goals for the operator. Effective management of the continuing airworthiness outcomes identified in this paper can be a key contributor to attaining the safety goals for an operator. As such it would be beneficial to incorporate these outcome measures, as listed in section 2.3, into an operator's Safety Management System.

The airline organisational culture model (Figure 2), developed from the 182 survey respondents, outlines a typology for Australian domestic airline staff involved in continuing airworthiness management activities. While the model does not represent the entire industry it does highlight areas of strong consistency between those operators surveyed. The main area of commonality is the empowerment of staff, where across all respondents there was a commitment to keeping aircraft safe. At an individual level, respondents believe they can make a positive impact. This cultural index rating for empowerment does not appear to be linked to the continuing airworthiness management performance of the operator; where individuals from all operators reported high levels of empowerment yet there were substantial differences in the airworthiness management performance of the operators surveyed. This highlights that variations in the continuing airworthiness performance of an airline is dependent upon factors other than the level of staff involvement.

When analysing the organisational culture and continuing airworthiness management data, there is a relationship between the strategic fit of the organisational culture with its environment and the continuing airworthiness management performance of that operator. The variations seen between the organisational Key Cultural Trait, Strategic Fit, can account for approximately half of the variations seen in the operators' performance of continuing airworthiness management. The Strategic Fit trait includes those aspects of culture that impacts attitudes and behaviour related to establishing and maintaining the goals and objectives of the operator, along with defining the means of achieving these targets. The strength of the culture of an operator's organisation, specifically those attitudes and behaviour related to setting, maintaining and implementing plans to achieve the goals and objectives, can have a large impact on keeping an operator's aircraft safe. This cultural trait can act as a predictor to the long term safety performance of an operator.

While the staff empowerment did not directly explain variations in performance, further research could investigate the interaction of staff empowerment, the Key Cultural Trait of Strategic Fit, and continuing airworthiness performance. This paper was written using domestic airline data but there is no reason to believe that the findings would not be equally applicable to smaller operators and operators of military aircraft where the airworthiness management is performed by an organisation not an individual, and leaders have responsibility to create and maintain the organisational culture needed to support the safety of aircraft.

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5 GLOSSARY OF TERMS

Airworthiness Directives - means a mandatory airworthiness requirement that specifies modifications, inspections, conditions, or limitations to be applied to an aircraft or aeronautical product to ensure continued safe operating conditions.

Alert levels – is purely an indicator, which when exceeded indicates that there has been an apparent deterioration in the normal behaviour pattern of the item with which it is associated.

Defect - means a change in the state or quality of an aeronautical product, a product, or a component that makes it unfit for its intended purpose and not in an airworthy condition.

HAAMC – Head of Aircraft Airworthiness and Maintenance Control is the person responsible for the operation and controlling the airworthiness and maintenance of aircraft operated under the AOC.

ICAO - International Civil Aviation Organization codifies the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth

MEL - is a categorised list of systems, instruments and equipment on an aircraft which are not required to be operative for flight. Specific procedures or conditions may be associated with operation with the relevant item inoperative

Service Bulletin - a notice issued by the manufacturer of an aircraft, engine or other equipment to alert people to problems with that equipment

Type Certificate - a document issued by the relevant NAA to indicate approval of the type design of a particular model of aircraft. The TC is issued by the relevant NAA as part of the aircraft type certification to the relevant airworthiness standards specified by that NAA

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