REDUCING OPERATING COSTS THROUGH PROACTIVE SAFETY: LESSONS FROM AUSTRALIA

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Abstract - This paper describes the development and evaluation of a practical, simple and cost effective proactive airline safety program called INDICATE1 (Identifying Needed Defences In the Civil Aviation Transport Environment) that has been applied within the Australian Regional airline industry. To evaluate the INDICATE program, a major Australian Regional airline agreed to implement the program in one of its operational bases while another base was used as a control group. A number of evaluation criteria were applied to determine whether the program would have a positive influence on the airline’s safety performance. Results from the trial suggest that the program improved staff confidence in how safety was managed, increased staff willingness to report safety hazards and incidents, improved organisational safety culture, and in some cases reduced operating costs. The application and cost effectiveness of the program within the Qantas group of Regional airlines is discussed.

1. Introduction

In Australia, the standard of Regional airline safety has received considerable attention because of a small number of highly publicised fatal aircraft accidents. As a result of these accidents, a report on the safety of the Australian General Aviation sector and Regional airlines, by the House of Representatives Standing Committee on Transport, Communications and Infrastructure, known commonly as the Morris Report, was released in December 1995. The report identified that there was a lack of information on low capacity regular public transport (RPT) operations and an absence of robust indicators on aviation safety. In addition, the report called for airline management to take full responsibility for safety, and that both the aviation industry and aviation safety authorities, must be more proactive in identifying safety deficiencies so that the potential for accidents is reduced.

In addition to public inquiries, the high social and economic costs of aviation accidents is forcing the Regional airline industry to consider proactive safety management programs as a means of improving how aviation safety hazards are identified and addressed. The Bureau of Transport and Communication Economics (1993) has reported that the social cost of aviation accidents in Australia is 76 million dollars or 1.7 million dollars per accident. For airline managers, an effective proactive safety program represents monetary benefits. However, despite these benefits there are currently few formal safety management programs designed to proactively prevent airline accidents within the Australian community. In part, this is due to a number of misperceptions that proactive safety programs are only applicable to high capacity aircraft operators, costly to implement and maintain, and require system safety expertise for effective management (Edkins, 1997; Edkins and Brown, 1996).

1.1. The development of the INDICATE safety program

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1 An account of this work has been published under the title “The INDICATE safety program: A method to proactively minimise aircraft accidents” in Safety Science, 1998, 30, 275-295.
There is a great deal of published material on the subject of safety management. Most of this material identifies the essential elements that make up a typical safety program. However, few authors provide a simple methodology from which to implement these essential elements and evaluate whether they are working. A review was conducted of existing safety programs. Within the aviation industry two programs were identified as useful sources; the British Airways MESH program (Reason, 1994) and the Boeing Safety Program Model (Boeing, unpublished). In addition, various aviation industry sources and guidelines were reviewed to analyse different approaches to safety management and accident prevention.

From this review, it was noted that there are clearly identifiable safety program elements that are typical to most programs. With these common core principles in mind, a safety program was developed and named INDICATE (Identifying Needed Defences In the Civil Aviation Transport Environment). The name was based on the underlying purpose of the program, which is to identify and resolve deficient aviation safety defences so that the potential risk of an accident is minimised. Safety defences are barriers or safeguards put in place to protect a system from both human and technical failure (Reason, 1995).

The INDICATE program involves implementing and maintaining six core safety activities:

1. Appointing an operational safety manager or officer who is available to staff as a confidante for safety related issues,
2. Conducting a regular series of staff focus groups to identify safety hazards within the organisation,
3. Establishing a confidential safety hazard reporting system,
4. Conducting regular safety meetings with management,
5. Maintaining a safety information database, and
6. Ensuring that safety information is regularly distributed to all staff.

For a more comprehensive account of how to implement the INDICATE program readers should refer to published work by Edkins (1998) and BASI (1997).

2. Study Aims

The objective of the present study was to trial the INDICATE program, within a major Australian Regional airline, to determine whether it would have a positive influence on airline safety performance, including cost savings. In addition, it was anticipated that the outcomes of this study might provide some useful methodological guidelines for organisations planning to evaluate other safety management programs.

3. Methodology

Cooperation was gained with an Australian regional airline in May 1995 and a sixteen-month trial commenced in July 1995. The participating airline operates out of two major regional centres. The INDICATE program was implemented in one regional centre (81 staff) while the other served as a control group (72 staff). Table 1 shows differences in application of the INDICATE program across the intervention and control groups.

3.1. Evaluation Criteria

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Information on how to obtain this database can be found at the end of this paper.
The INDICATE program was evaluated based upon four safety performance criteria administered over the following three time periods:

- Time 1 – prior to the implementation of the program in the intervention group
- Time 2 – at the eight-month stage of the trial and prior to the implementation of the program within the control group
- Time 3 – at the sixteen-month conclusion of the trial.

<table>
<thead>
<tr>
<th>SIX CORE ELEMENTS OF THE INDICATE PROGRAM</th>
<th>INTERVENTION GROUP</th>
<th>CONTROL GROUP</th>
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<tbody>
<tr>
<td>1. Appointing an operational safety manager or officer who is available to staff as a confidante for safety related issues</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>2. Conducting a regular series of staff focus groups to identify safety hazards within the organisation</td>
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</tr>
<tr>
<td>3. Establishing a confidential safety hazard reporting system</td>
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<tr>
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<td>No</td>
</tr>
</tbody>
</table>

Table 1. Differences in application of the INDICATE program across both experimental groups

1. Safety culture

The Airline Safety Culture Index (ASCI) (Edkins & Coakes, 1999) was developed to measure safety culture specifically within an airline environment. Based upon a review of previous research (e.g., Brown & Holmes, 1986; Cooper, 1995; International Civil Aviation Organization, 1992) the instrument consisted of 25 positively worded statements, each requiring a response on a five point Likert scale ranging from strongly agree to strongly disagree. 153 questionnaires were returned at time 1 indicating an 80% response rate. At time 2, 151 questionnaires could be matched to time 1. At time 3, 150 questionnaires could be matched to both time 1 and time 2.

At both the eight and sixteen month stage of the trial, it was expected that the intervention group would demonstrate a better safety culture score compared to the control group. Furthermore, it was expected that the control group would demonstrate a better safety culture result at time 3 compared to time 1 or time 2.

2. Staff willingness to report safety hazards and incidents

A review was conducted of existing confidential hazard reporting systems currently in use within the aviation industry (e.g. ASRS, CAIR) and a confidential hazard reporting form was developed. At the conclusion of the trial, it was expected that the intervention group would have submitted more hazard report forms, compared to the control group, because of their increased awareness of safety hazards and the INDICATE program’s emphasis on safety communication.

3. Staff comments about how safety is managed within the airline

Staff were given an opportunity to comment on how safety was managed in their company over the three time periods. This qualitative information was compared across the
intervention and control groups. It was expected that airline staff within the intervention group would have generally more positive comments about safety management within the company, compared to the control group, at the end of the trial.

4. Action taken on identified safety hazards and estimated cost savings

The implementation of the INDICATE program within the airline provides a structured framework to address safety hazards. Therefore, the number of hazards addressed between both experimental groups were compared at the eight and sixteen month stage of the trial period. It was expected that the intervention group would have achieved more action on safety hazards, compared to the control group. In addition, potential cost savings were calculated where possible to determine program cost efficacy.

3. Results

3.1. Safety culture

In order to determine the significance of safety culture scores, on different groups, across time, a number of statistical tests were undertaken. These tests revealed that at time 1, the intervention group (M= 59.63) had a significantly better safety culture (i.e. a lower mean) in comparison to the control group (M=70.53).\(^3\) At time 2, the intervention group (M=44.08) demonstrated a significant drop in their mean safety culture score, while the control group (M=73.67) had increased their mean score slightly. Again, this difference was statistically significant.\(^4\) At time 3, the intervention group (M=40.01) continued to demonstrate a decline in their mean safety culture score, indicating a more positive group safety culture. However, of particular note is the lower mean safety culture score demonstrated in the control group (M=53.36), compared to time 1 and time 2, following an eight month exposure to the INDICATE safety program.\(^5\) Figure 2 presents a graphical representation of the mean safety culture differences for both experimental groups over the three measurement periods.

As expected, for participants within the intervention group, planned comparisons indicated that safety culture ratings were significantly higher (e.g. poorer safety culture score) at time 1 (M = 59.63), than safety culture ratings at time 2 (M = 44.08) and time 3 (M = 40.01).\(^6\) Similarly, as expected, for participants within the control group planned comparisons indicated that safety culture ratings were significantly lower (e.g. a better safety culture score) at time 3 (M = 53.36), than average safety culture ratings at time 2 (M = 73.67) and time 1 (M = 70.53).\(^7\)

These results suggest that safety culture significantly improved as a result of the INDICATE safety program.

NOTE: The lower the mean the better the safety culture

\(^3\) An independent samples t-test revealed that this difference was statistically significant, \(t(1) = -4.46, p < .02\)
\(^4\) An independent samples t-test revealed that this difference was statistically significant, \(t(1) = -14.34, p < .02\).
\(^5\) An independent samples t-test revealed that this difference was statistically significant, \(t(1) = -7.41, p < .02\).
\(^6\) A One-way ANOVA revealed that this was significant, \(F(1, 160) = 882.46, p < .0001\)
\(^7\) A One-way ANOVA revealed that this was significant, \(F(1, 136) = 208.47, p < .0001\)
Figure 2. Airline safety culture mean score differences by group across time

3.2. Staff willingness to report safety hazards and incidents

The total number of hazard reports submitted across time 2 and time 3, for both experimental groups, is shown in Figure 3.

Figure 3. Submitted hazard reports for time 2 and 3

These results indicate that, at Time 2, the intervention group (48 reports) submitted more than five times as many reports as the control group (9 reports). This
difference may be a direct result of an attitude change within the intervention group facilitated by the implementation of the INDICATE program. For example, a more positive attitude to reporting safety issues, increased staff confidence in safety problems being addressed, more awareness amongst staff of operational hazards and improved staff commitment to improving company safety.

At time 3, the intervention group (60 reports) continued to indicate an increased willingness to report safety hazards. In contrast, the control group demonstrated a four-fold increase in the number of hazard reports (31 reports) submitted from time 2 to time 3, following an eight-month exposure to the safety management program. This four-fold change within the control/delayed intervention group represents an increased willingness of participants to report safety hazards.

3.3. Staff comments about how safety is managed within the airline

**Intervention group**

Airline staff within the intervention group were generally much more positive about safety management within the airline, following the implementation of the INDICATE program.

“... I think the INDICATE program is a great idea and with its persistence will force management into improving areas and procedures that are unsafe”.

“... there are countless things that can trip up an airline in regard to safety. It’s a fine balance between safety and economics. Vigilance is the best safety net, therefore programs like this make me feel that this is a safe airline”.

**Control group**

Airline staff comments within this group were generally a lot more negative than the intervention group, particularly in regards to a lack of communication from management, poor confidence in management’s ability and unwillingness to report safety incidents for fear of retribution.

“... people are reticent to share experiences and discuss safety incidents they may have had, as they feel their positions will be under threat”.

“... there is a general feeling that management practices are reactive and not proactive. For example, staff punishment for accidents and incidents where a more lenient approach would have had a superior result and prevent repetition of an incident”.

Overall, the intervention group (48 positive and 49 negative) recorded more positive comments compared to the control group (18 positive and 79 negative). This finding is consistent with the expectation that airline staff within the intervention group, would have generally more positive comments about safety management within the company, compared to the control group, due to their longer exposure to the safety intervention.

3.4. Action taken on identified safety hazards

A number of safety hazards within the company have been addressed since the implementation of the INDICATE program. The use of the program to resolve these safety
deficiencies has assisted the airline in improving safety standards in areas where, historically they have had limited progress. In addition, in some cases significant cost savings have been achieved.

- **Poor passenger control on tarmac** - The passenger walkway markings between the airport terminal and the aircraft loading bay were identified as being unclear. Consequently, passengers sometimes wandered around the tarmac area unsupervised or boarded the wrong aircraft, resulting in scheduling disruptions and late departures. The Airport authority has subsequently repainted equipment clearance lines and passenger walkways to assist in the better direction of passengers to the aircraft. As a result, on-time departures from this airport have improved.

- **Instrument approach designs** – It was identified that the instrument approach designs for some Regional airports are impractical and are a potential safety hazard because of the need to perform low circling approaches when visibility is poor. Recommendations were forwarded to the Civil Aviation Safety Authority to address these problems. At one location the subsequent redesign of the instrument approach, to a more practical runway aligned approach, has resulted in significant cost savings, in terms of fuel and time for the airline, in addition to the recognised safety benefits.

- **Runway 30 at Canberra airport** - The runway 30 approach at Canberra was identified as a potential safety hazard due to its short length, high terrain on approach, lack of adequate approach lighting and resultant high workload. Jeppeson Australia subsequently included a clearer warning note on future chart editions about high terrain on the runway 30 approach. This has resulted in less Ground Proximity Warnings (GPWS) warnings, saving valuable resources previously committed to the cost of safety investigations. In addition, the Canberra Airport Authority has installed a Precision Approach Path Indicator (PAPI), which has significantly improved the safety of this approach in conditions of poor visibility and reduced the cost of time and fuel from the incidence of go-arounds.

4. **Cost benefit analysis of the INDICATE program within the Qantas Group of Regional airlines**

   The INDICATE program has been operating in two of the Qantas Regional airlines, Sunsate and Southern Australia Airlines, for over twelve months. The third Qantas Regional carrier, Eastern Australia Airlines, has only recently adopted the program. The following safety deficiencies have been identified and satisfactorily addressed through a confidential safety hazard reporting system operating within each Qantas Regional airline. They are provided as examples of how proactive safety efforts can potentially reduce operating costs.

- **Dash-8 Seatbelts** - when passengers vacate their seats, the long strap of the seat belt often falls into the aisle, resulting in a potential hazard for crew and passengers (there have been cases of crew tripping over) and an impediment in the event of evacuation. In addition, the short piece of the strap for both seats are in the centre of the seats, which can result in the first passenger sitting on their own strap and using the adjacent passengers strap. Consequently, the second passenger can be reluctant to speak up and may pretend that their own seat belt is fastened as recent incidents have demonstrated. Engineering have subsequently reversed all passenger seatbelts on the
Dash 8 fleet so that the short strap is on the aisle side of the seat, effectively reducing the company exposure to costly compensation claims from injury to crew or passengers.

- **Dash 8 Boarding Stairs** - it was reported that the gas struts, door linkages and door handle locking mechanisms for the boarding stairs on the Dash 8 aircraft were continually being damaged from flight attendants "riding on" the stairs as they were being lowered to the ground. Repair bills ranged from A$700 to replace the gas struts to A$1700 to repair the door handle locking mechanism. Investigation revealed that when gas struts are new they offer more resistance and consequently some flight attendants have trouble lowering the stairs. This problem has been rectified and a memorandum was issued to all flight attendants instructing them not to ride on the stairs as they are being lowered. As a result, the cost of repairs has been dramatically reduced.

- **Ramp Safety** - a number of reports were submitted regarding the poor supervision of passengers walking between the Dash 8 aircraft and the Melbourne airport terminal. Passengers have boarded the incorrect aircraft, walked in the vicinity of a mobile aerobridge and vehicle movements between the terminal and the aircraft have resulted in costly incidents where aircraft have been damaged or passengers have walked dangerously close to moving ramp traffic. Three incidents alone have cost the airline A$24,500 from equipment damage, repairs, labour and cost of ferry flights. Cones (witches hats) have subsequently been introduced to mark a pedestrian walkway between the aircraft and the terminal, and also to restrict vehicle movements in this area. The introduction of A$1000 worth of cones has resulted in no further incidents and improved the overall safety of ramp operations.

5. **Conclusion**

The evaluation of the INDICATE program illustrates that the greatest source of variance in airline safety is not necessarily aircraft equipment or the category of operation, but the real cost comes from the safety culture of organisations within the aviation system. A small to medium size airline, operating on a limited budget, does not have to spend large amounts of money to improve its own safety culture. However, the benefits from implementing initiatives like safety management programs will ultimately help to improve operational safety and in some cases reduce operating costs.

Currently over twenty passenger carrying operators of varying size in both Australia and overseas have implemented the INDICATE program. It is hoped that the relatively simple process of implementing and maintaining the program will encourage passenger-carrying operators to go beyond the minimum regulatory safety requirements and strive for “best practice” in aviation safety.

More information on the INDICATE program is available from the author and developer of the program. For information on how to obtain the safety program database contact: The Bureau of Air Safety Investigation, PO Box 967 Civic Square, ACT 2602 Australia, Fax: + 61 26 247 3117; http://www.basi.gov.au.

**References**


