Advisory Circular

AC12-2

Revision 1 (0)

Incident investigation

31 March 2016

General

Civil Aviation Authority Advisory Circulars contain information about standards, practices, and procedures that the Director or the Authority have found to be acceptable for compliance with the associated rule.

Consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate Advisory Circular.

Purpose

This AC provides guidance when investigating and submitting incident investigation reports in accordance with Part 12.

Related Rules

This Advisory Circular relates specifically to CAR Part 12 rule 12.59.

Change Notice

Subject to “Memorandum for Technical Cooperation” between the CAA of Mongolia and New Zealand on mutual cooperation in implementation of Assembly Resolution A29-3: Global Rule Harmonization, 29th ICAO Assembly, 1992, which urges States to promote global harmonization of national rules, dated 6th of May, 1999, Mongolian Civil Aviation Safety Regulation has been reconciled to the Civil Aviation Regulation of New Zealand.

Amendment 164 of Annex 1 to the Chicago Convention on International Civil Aviation urges flight crew members, ATC personnel and aircraft maintenance engineers to comply with the language proficiency requirements; and

Under Article 14 of the Civil Aviation Law of Mongolia 1999, “Use of foreign language in civil aviation” the AC has been released in English version only, in order to prevent any mistranslation and misuse of the aviation safety related documents.

Table of Contents

Introduction

ICAO and others have carried out much academic work recently into new methods for looking at accidents and incidents. These methods focus on the systematic organisational approach, rather than concentrating on the active failures, which has been a feature of recent past investigations. It is important that a more balanced approach, using both active and latent failure information, is adopted in the future.

This material is intended for certificate holders who are required to investigate and submit a report about certain incidents. This Advisory Circular relates specifically to CAR Part 12 rule 12.59.

CAR Part 12 requires certain certificate holders to notify and to provide details to the Authority of specific types of incidents. This rule is aligned with the certification requirement for organisations, which require them to establish an internal quality assurance system. Part 12 investigation and reporting requirements should be incorporated in this system.

This AC describes an investigation system compatible with the CAA's database and the ICAO reporting system.

The CAA has issued AC 12-1 *Mandatory Occurrence Notification and Information* and this should be read in conjunction with this AC 12-2. These same certificate holders are subsequently required to investigate the incidents and submit a report of their investigation to the Authority. They are also required to advise the Authority of any actions taken to prevent recurrence of a similar incident. This information will be entered into the CAA database and any agreed corrective actions tracked to completion.

The CAA will analyse the reports to determine if any corrective action is needed on a wider basis.

Occurrence Investigation

The CAA may wish to take part in the organisation's internal investigation or conduct an independent investigation. However, where this is not the case, compliance with the following guidelines should result in effective actions that are compatible with the CAA database. The CAA recognises that not all companies have trained investigators. The CAA maintains a group of qualified specialists who may be consulted for advice or assistance. The emphasis in Part 12 is for industry to be responsible for conducting its own investigations thereby contributing to their quality assurance system for corrective and preventative actions.

Filling in the Investigation report form – CA005 pages 3 & 4

This section relates to filling in pages 3 and 4 of form CA 005. The blue fields at the top of the page are for CAA use. The form contains a number of fields that match data fields in the CAA database.

The following table provides brief advice on the information required in each field.

Data Field	Filling Advice
Finding No	This is the number assigned to the finding by the CAA computer. No submitter action required
File Number & Work Request	The CAA Job Number/Work Request Number for the work being done when the finding was made. No submitter action required
Date and time of Occurrence	This must be the same as the initial notification details submitted on the original method of communication.
Location	The geographical location where the occurrence happened or where it was identified. Use the 4-letter ICAO location indicator (for example ZMUB) or a 4 digit Post Code. If there is no known location indicator or post code use a description of the nearest recognisable city or town. (See MGL AIP Planning Manual for a complete list of MGL location indicators).
Aircraft manufacturer and model	The popular name of the aircraft and model.
Aircraft registration JU-	The Registration mark of an aircraft involved (if applicable).
Finding attributed to: name	The name of the involved client whether an organisation or person
Client ID	The licence or approval number of the organisation or person.
Aviation document	The rule part or regulation under which the aviation document affected by the finding was issued. Prefix rule parts with P, regulations with R. (for example P145 or Part 145, R191 or Reg. 191).
Rule Reference	The specific Civil Aviation Rule, Regulation, or suchlike on which the finding is based. This must be completed for all non-compliance and non-conformance.

Manual Reference	The client's manual, and sub-reference, against which the finding is made. This must be completed for all non- compliance and non-conformance.
Non-compliance	A failure by a person or organisation to comply with Civil Aviation legislation, a Civil Aviation Rule or a condition attached to an Aviation Document. Tick if applicable.
Non-conformance	A failure by a person or organisation to conform with a provision of any document forming in whole or in part the agreed standards or condition on which the issue and continuance of an Aviation Document depends. Tick if applicable.
Observation	Something the investigator wishes to comment on that will be helpful to the organisation or individual. Tick if applicable.
Safety Related Concern	A finding relating to a practice or concern that cannot be related to legislation or a standard. Tick if applicable.
Critical	An occurrence or deficiency that caused, or on its own had the potential to cause, loss of life or limb. Tick if applicable.
Major	An occurrence or deficiency involving a major system that caused, or had the potential to cause, significant problems to the function or effectiveness of that system. Tick if applicable.
Minor	An isolated occurrence or deficiency not indicative of a significant system problem. Tick if applicable.
Description	Enter a concise but accurate description of the problem, include as appropriate, any references to approved data, maintenance manuals and the like. If any non-compliance with company procedures is involved then this should be stated together with any references.
Cause	One or two causes may be recorded for each finding. Use the definition of causal factors from the lists provided where possible. Use additional pages if more than two causal factors have been identified.
Person/Organisation	This field corresponds to a field in the CAA database. When the finding is entered into the database, the most appropriate selection from a computer generated option list is selected. Some of

	the appropriate numbers are listed in Appendix A and may be used instead of text.
Category	As for person/organisation.
Item	As for person/organisation.
Client closing actions	This space is for the client to enter details of actions taken to close the Recommendations or Corrective Actions..
Completion Date	The date on which the corrective action was or will be completed.
Estimated or Actual cost associated with the occurrence and corrective actions.	This may include but is not limited to: Repairs to aircraft, Other repairs, Investigators Time and travel costs, Aircraft delay costs, Aircraft diversion costs, Passenger accommodation costs Fuel dumped or burned off costs. Loss of revenue, Hidden costs (uninsured loss and suchlike.). Enter the total cost amount.
Name	The name of the company representative raising the finding
Position	The position in the company exposition of the company representative raising the finding notice..
Organisation	The Name of the company raising the finding notice
Client ID	The licence or approval number of the organisation or person.
Date	The Date on which the finding was raised. This may be different to the date associated with the occurrence.
Phone number	The daytime contact number of the reporter.
Reporters ref number	This space is for the client to enter details of any reference number previously allocated to the occurrence and is used to tie the finding to the submitter's original reference number.

The following explains the steps to be taken derived from the codes contained in Appendix A.

After entering the **Description**, decide on the **Person/Organisation**; decide on the category by choosing from **Local Violation**; **Local Error or Organisational Failure**; select the appropriate item; then write up the causal factors. It may be easier in some cases to decide on what the corrective action should be and then work back from this to isolate the cause. The corrective action must treat the cause.

These steps will allow the organisation to determine whether an occurrence has been effectively investigated and analysed. Inability to determine the information in one of the steps will indicate that further investigation or analysis is required.

Person/Organisation

The code numbers should be entered on the reporting form. Examples of how these can be used in relating to causal factors are as follows:

	Person/Organisation	Category	Item
1.	Maintenance Engineer **1291**	Active Failure **1359**	Incorrect system diagnosis **1362**
2.	Maintenance-Management **1222**	Organisation Failure **1295**	Poor Training **1306**
3.	CAA - General **1266**	Local Error Factors **1314**	Designer/User Mismatch **1319**
4.	Pilot-in-command **1272**	Local Violation Factors **1344**	Hazard Misperception **1350**

Investigation Report findings

1. The description must be clear, must stand on its own, and must not be a repeat of the occurrence description. It must clearly indicate the nature of the failure.

2. The cause statement must match the description and must clearly indicate **who** is involved and **why** the failure occurred. The '**who**' must be either a **person** (or group of persons) or alternatively must be an **organisation** (or system).

3. If a **person** is identified in the cause statement then the cause must be coded to either a Local Error, Local Violation or an Active Failure. If an **organisation** is identified in the cause statement then the cause must be coded to an Organisational Factor or Local Error. These are known collectively as General Failure Types (GFT).

The action that is carried out must treat the cause.

Cause

An important aspect of any investigation is the determination of causal factors that lead to the occurrence. The identification and definition of a causal factor can often be seen as the answers to three questions:

- Who was responsible?
- What was the area of involvement?
- What was the nature of the involvement?

The CAA database uses a reporting code to allow sorting of stored data. For organisations, who in future wish to take advantage of direct electronic transfer of data, the appropriate causal factor codes can be used from Appendix A. In this way a

computer sortable code is achieved and Pareto analysis of the predominant causal factors can be carried out.

While this approach is fine for computerised systems it is necessary to add free text to elaborate on the causal facts. For organisations not wishing to use the cause code facility a description is all that is required. In this case asking the question '**why**' three times will usually get to the root cause of most occurrences. The selection of more than three individual separate cause factors may indicate that the true root causes have not been identified and further investigation may be required.

Clients Closing Action

This should indicate the required course of corrective action that the organisation has taken or will take to ensure that the occurrence does not happen again. The date for compliance completion must be stated. Corrective actions may include immedia te, intermediate and long-term aspects being:

Immediate Corrective: Steps taken by the company or individual to resolve any urgent safety problems or non-compliance with regulations before further operations.

Intermediate Preventative: Steps taken to ensure appropriate procedures are documented and adhered to. This should preclude repetition of the occurrence.

Long Term Preventative: Steps to incorporate self-checking (Quality Assurance) procedures to ensure that the above actions remain effective.

Explanatory Notes

For every reported human error in accident and incidents there will be a selection of organisation failings that set the conditions in which the error occurred. Human beings will make errors more frequently when certain conditions exist, these conditions have been broadly classified into 18 general failure types (GFT) These occur at management level or are under direct management control.

For the occurrence under consideration it is necessary to be able to identify those aspects of organisations that lead to failure. Of course, more than one GFT may contribute to any one failure. The general failure types are listed in Appendix A.

Analysis

In analysing the findings of an investigation it is possible to use the failure model documented in the ICAO Human Factors Digests (see page 22 for details). It is important to consider that the findings documented in the investigation report are the result of complex interactions between many causal factors. These may be considered as:

(a) **active failures** committed by the pilots, engineers, air traffic controllers and others, having an immediate impact upon the safety of the aviation system;

(b) local triggering factors relating to the **task and environment**; and

(c) latent or hidden failures, originating in the managerial and **organisational** spheres of influence, whose consequences may lie dormant for long periods.

Using the model allows the basic facts of the investigation to be assembled into a coherent and remedial useful analysis, this is summarised by looking at the failed defence mechanisms and addresses the fallible top-level decisions that set the sequence in motion.

From a legislative and quality systems point of view, the requirements for participants in the Civil Aviation system as follows:

“Every participant who holds an aviation document that authorises the provision of a service within the civil aviation system –

(a) Shall, if so required by rules made under this Act, establish and follow a management system that will ensure compliance with the relevant prescribed safety standards and the conditions attached to the document; and

(b) Shall provide training and supervision to all employees of the participant who are engaged in doing anything to which the document relates, so as to maintain compliance with the relevant prescribed safety standards and the conditions attached to the document and to promote safety; and

(c) Shall provide sufficient resources to ensure compliance with the relevant prescribed safety standards and the conditions attached to the document.”

These three areas detailed above are the core of the aviation systems defences. Rules made under the Civil Aviation Act define acceptable boundaries within which to operate.

Failed Defences

What aspects of the defensive system were absent, failed or circumvented?

It is important to discover how the company systems put in place to prevent the occurrence were bypassed or rendered ineffective by something that someone did.

Unsafe Acts

What types of actions were involved in breaching or bypassing the defences?

It is important to discover if the people involved deliberately breached the rules and company procedures or were just not aware of the requirements.

Pre-conditions

What were the task or environmental factors that promoted the occurrence of these unsafe acts?

Task unfamiliarity, time shortage, not following procedures and poor design of equipment are known to be major contributors in this area.

General Failure Types

What organisational deficiencies were involved?

These are usually under the direct control of the organisations management. Which of the 18 GFTs were involved. What shortcomings do the incident reveal in the organisations safety culture?

Recovery Measures

What saved the day?

It is important to discover what part of the aviation system made the difference and stopped the incident becoming an accident.

Occurrence Costs

Each occurrence represents a cost to the system in dollar terms. These costs can be quantified and analysed to show the extent of the drain on company resources. Industry looses many dollars each year partly because little attempt has been made to quantify the cost associated with these failures. Rule Part 12 recognises the concept of safety at reasonable cost and space has been provided on form CA 005 to record the total cost of the occurrence. Rectification actions should be included in the measurement of the cost of incidents. By applying appropriate preventative measures safety should be enhanced and future losses may be avoided.

Investigation Report

Once the company investigation is finished and underlying causal factors established, the Investigation Report should be completed as far as possible and the information fed into the company quality assurance system. The completed Form CA005 should then be sent to the CAA.

Where internal investigations have resulted in significant amounts of photographs, and other reference material, copies should be made and submitted as attachments to the form CA005.

The commercially available Aviation Quality Database (AQD) is an acceptable means of compliance for submitting information by direct electronic transfer of information as an alternative to completing form CA005.

Other direct electronic transfer systems may be submitted to the CAA for acceptance. A detailed specification is available on the CAA web site or is available from the CAA.

Appendix A - Reference Tables and Definitions

General Failure Types

The codes from the following tables have been referenced in the CAA database to the basic codes in the ICAO accident and incident reporting manual, document number 9156-AN/900. Proper selection of these codes helps the CAA to comply with the reporting requirements of Annex 13 to The Convention on International Civil Aviation (Accident and Incident Reporting).

Organisation Failure Items

Inappropriate Goals Or Policies	1296
Organisation Structural Deficiencies	1297
Inadequate Communications	1298
Poor Planning	1299
Inadequate Control And Monitoring	1300
Design System Deficiencies	1301
Inadequate Defences	1302
Unsuitable Materials	1303
Unsuitable Equipment	1304
Poor Procedures	1304
Poor Training	1306
Poor Coordination	1307
Inadequate Specifications/Requirements	1308
Poor Decisions	1309
Poor Resource Management	1310
Poor Work Environment	1311
Inadequate Regulation	1312
Other Organisation Factor	1313

Organisation Failure definitions

1. **Inappropriate goals or policies:** Unclear or inappropriate organisation goals or policies that may compromise or conflict with required or expected safety objectives and priorities. For example an organisation’s sole goal may be to make a financial profit with no mention of safety objectives.
2. **Organisational structural deficiencies:** Ambiguous, vague or otherwise inadequate definition and implementation of personnel responsibilities and authorities and in particular, interrelationships between key personnel. Tasks

and activities not being carried out by appropriate personnel. For example the CEO of an organisation having a heavy involvement in day to day operational matters.

3. **Inadequate communication:** Deficiencies in the provision, or transfer, of information at both the formal and informal level between key personnel either within or beyond the organisation For example poor communication with the regulatory authority and poor two-way communications between management and staff.
4. **Poor planning:** Inadequate effort or resource dedicated to effective planning. Little in the way of a structured approach to planning activities. Little forethought given to the likely consequences of proposed changes.
5. **Inadequate control and monitoring:** Lack of, or inadequate monitoring, supervision and feedback systems for ensuring the proper control of processes. This will be most likely evidenced by variability in the quality of the actual products or services delivered by the organisation.
6. **Design deficiencies:** Design of equipment does not meet stated requirements. This will be evidenced by failures or deficiencies occurring at a rate higher than that expected.
7. **Inadequate defences:** Lack of error tolerant or fail safe procedural or physical systems giving the potential for otherwise minor problems to result in major or critical occurrences..
8. **Unsuitable materials:** The use of contaminated materials, non approved parts, or material of an inferior quality. It might also include the use of unsuitable software.
9. **Unsuitable Equipment:** The facility, installation, system tools or measuring equipment is incapable or otherwise unsuitable to perform the operations required.
10. **Poor procedures:** Vague, ambiguous, misleading, or the complete absence of documented procedures for ensuring the control of processes and hence the quality of products and/or services.
11. **Poor training:** Non-existent or inappropriate training of personnel. The balance struck between knowledge and training requirements must be adequate to meet the demands of the tasks and operations required to be performed by personnel. People who have not been trained properly will often be operating at their general knowledge based level rather than completing tasks using learned rules or skills.
12. **Poor co-ordination:** Inadequate operation of a company or inadequate management of projects, stemming from shortcomings in the ability to bring people and resources together at the right place at the right time.

13. **Inadequate specifications or requirements:** Incorrect, vague, ambiguous, misleading or complete absence of specifications or requirements necessary to assure the quality of a product or service.
14. **Poor decisions:** Incorrect or otherwise inappropriate decisions made by key personnel due to the misinterpretation of valid information or inappropriately qualified personnel assigned to the decision making process.
15. **Poor resource management:** Inadequate assignment or allocation of resources to ensure that products or services meet quality and, in particular, timeliness requirements. Resources inadequate for planned tasks.
16. **Poor work environment:** Adverse working conditions or other conditions limiting human capabilities, for example inadequate lighting or heating. Distraction created by excessive noise. Housekeeping items such as accumulation of rubbish in the work area.
17. **Inadequate regulation:** This relates to internal application of statutory rules and monitoring by outside agencies. Where regulations are not followed or monitoring is poor then organisations may not be aware of how this can contribute to incidents.
18. **Other:** For example, the working environment is greatly influenced by the culture of the organisation. On occasions, failure by regulators and management may not always address the negative influences that environment and culture can have. Industrial strife is one other area that may have a detrimental impact.

The investigator should strive to identify at least one casual factor from the above list. The text in these definitions may be used to describe what was found. Action taken to correct problems at this level in the organisation should provide the most cost effective improvements to safety.

Organisation/Person Items

Aircraft Operator - General	1211
Training Organisation - General	1216
Maintenance Organisation - General	1221
Manufacturer - General	1226
Aerodrome Operator - General	1231
Air Traffic Service Provider - General	1236
Aero Telecomms Provider - General	1241
AIS Provider	1246
Met Service Provider - General	1251
Security Service Provider - General	1256

Freight Forwarder/Courier - General	1261
CAA - General	1266

Each of the above may be further broken down by the following sub-headings.

Head Office Management
Unit Management/Supervisory
Staff
Other

Individuals may be generically defined by the following.

Person	
Pilot-in-command	1272
Co-pilot	1273
Instructor/check pilot	1274
Pilot of other aircraft	1275
Dual student/pilot under check	1276
Flight engineer	1277
Other flight crew	1278
Cabin crew	1279
Passenger	1280
Loader	1281
Driver of vehicle	1282
Ground instructor	1283
Ramp/line crewman	1284
Flight ops officer/dispatcher	1285
Air traffic controller	1286
Flight service officer	1287
Meteorological briefer	1288
Meteorological forecaster	1289
Telecommunications technician	1290
Aircraft maintenance engineer	1291
CAA assessor	1292
Member of public	1293
Other	1294

Task/Environment Error Items

Task unfamiliarity	1315
Time shortage	1316
Poor signal:noise	1317
Poor human-system interface	1318
Designer user mismatch	1319
Error irreversibility	1320
Information overload	1321
Negative task transfer (habits)	1322
Task overload	1386
Risk misperception	1323
Poor system feedback	1324
Inexperience (not lack of training)	1325
Lack of knowledge	1326
Task/education mismatch	1327
Poor instructions/procedures	1328
Inadequate checking	1329
Hostile environment	1330
Other environmental factor (eg weather)	1331
Interpretation difficulties	1332
Disturbed sleep patterns	1333
Fatigue - other	1334
Drugs/alcohol	1335
Visual illusion	1336
Disorientation/vertigo	1337
Physiological other	1338
Monotony/boredom	1339
Lack of confidence	1340
Poor attention span	1341
Psychological other	1342
Other error enforcing condition	1343

Task/Environment Violation Items

Lack of safety culture	1345
Management/staff conflict	1346
Poor morale	1347
Poor supervision & checking	1348
Group violation condoning attitude	1349
Hazard misperception	1350
Lack of management care/concern	1351
Lack of pride in work	1352
Risk taking culture encouraged	1353
Complacency (ie it can't happen)	1354
Learned helplessness (ie who cares)	1355
Perceived license to bend rules	1356
Age/sex factor	1357
Other violation enforcing condition	1358

Active Failure Items

No opportunity for **intervention** (structural/mechanical/other error)	1360
Information not detected (information error)	1361
Incorrect system **diagnosis** (diagnostic error)	1362
Incorrect **goal** chosen (goal error)	1363
Incorrect **strategy** chosen (strategy error)	1364
Procedures inconsistent with strategy (procedure error)	1365
Actions inconsistent with Procedures (action error)	1366

Questions

The following questions listed below have been devised in order to assist in determining the **active failure** committed by the individuals involved in the event.

As soon as the individual has answered **no** to a question from Part A, you should have identified the active failure that was involved, and this should be entered as a causal factor on the report form. In order to determine the **task or environment** causal factors refer to the appropriate lists above and ask further questions. Typical examples of questions to ask are given in Part B below.

Part A – Active failure identification

		YES	NO
1	On the basis of the available **information** were you able to correctly determine the nature of the problem		
2	Looking back, was your choice of **goal** the most suitable in the circumstance? (A goal is an answer to the question: "What is the next priority?"		
3	In order to achieve this was your general approach or **strategy** the most suitable one you could have followed.		
4	Where the actual steps or **procedures** you followed the most suitable for carrying out this general strategy?		
5	Were the **actions** carried out exactly as intended		

Part B – Causal factor identification

		YES	NO
1	Were there any distracting sounds or signals from another person		
2	Where there any distracting sounds or signals (internal or external) from any other source?		
3	Did the workload become excessive		
4	Did the performance of one task interfere in any way with the performance of another		
5	Did the situation call for knowledge or skills which had not been imparted in training		
6	Did the knowledge or skills acquired in training turn out to be incorrect in the circumstances		
7	Were you physically incapacitated by any cause (acute illness, injury etc.)		
8	Was your mental state affected by any cause (on going ill health, drugs, alcohol, recent stressful experiences, fatigue or tiredness for example)		

Appendix B

Latent failure models

The following two diagrams are designed to show the basic principles of the latent failure model.

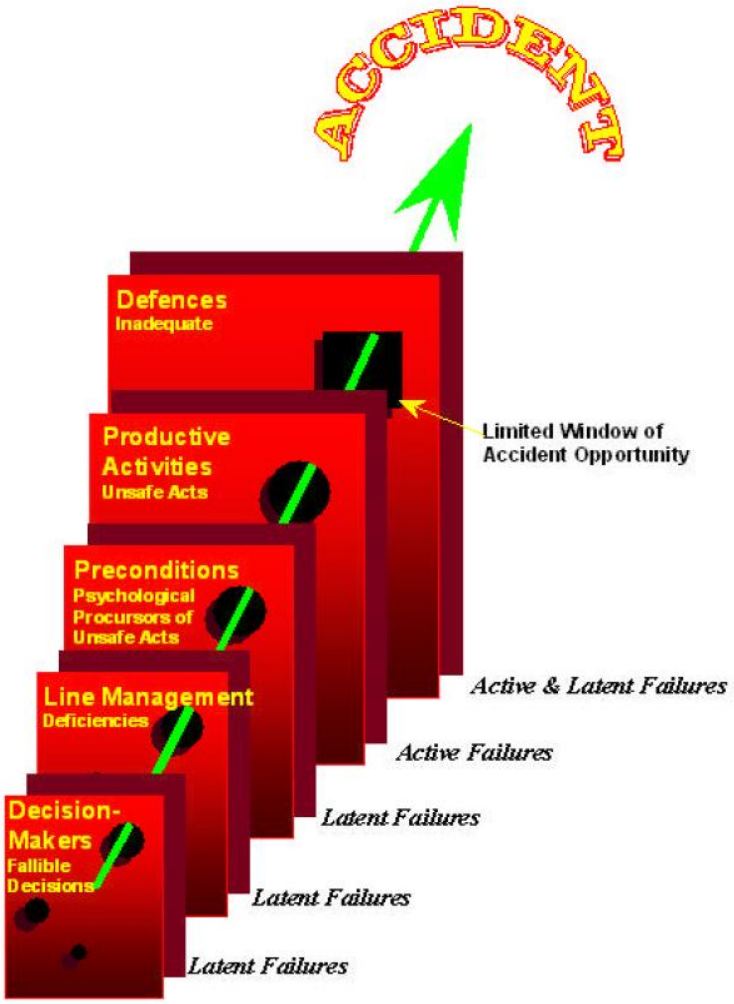


Diagram 1

Diagram 1 shows the layers of defences that have been created within the aviation system to prevent accidents and incident happening. It also shows how these defences have holes in them. When these holes line up the window of opportunity is there. All that is needed to complete the breach in the defence is an active failure at the operational level. When this happens an accident occurs. When the defences in the system work properly and are only partially breached the end result may be an incident. Incidents are free lessons that should be investigated to show where the holes (latent failures) in the system are. Holes in the system are there all the time and a good pro-active audit program should also help in detecting them.

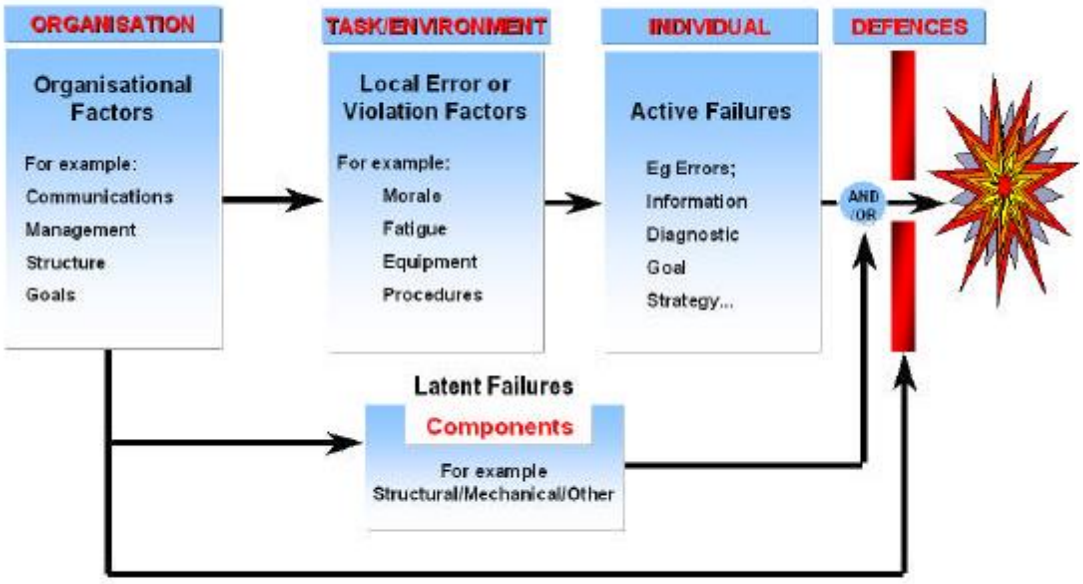


Diagram 2

Diagram 2 shows how the latent failures are grouped into 3 areas.

1 The active failures.

2 Task/environment or local factors.

3 Organisational factors.

These correspond to the list at Appendix A. There is another area where failures may occur which is represented in Diagram 2 by **Components**. This relates to failures in components that have been manufactured or overhauled outside Mongolia. When one of these components fails then the latent failures represented by the failure model may be present, and the overseas organisation concerned should be contacted to determine the root cause of the failure.

Latent failures should be grouped together, and as a minimum, organisational factors (known as general failure types GFT) should be found for each occurrence. These can then be subject to analysis to determine which problems are causing most concern. The intention is to interrupt the accident chain as high up in the management structure as possible. These methods focus on the systematic organisational approach rather than concentrating on the individuals who were present at the coalface when the event occurred. This approach is now widely accepted to be where an organisation can concentrate its efforts to make the most cost effective improvements to safety.

Models of human error — Rasmussen, Norman and Reason.

The “Reason Model” has been chosen as the method that CAA will use to classify occurrence data. This is not the only model that would work for data capture nor is it the ‘correct model’ — it is merely one that has been used successfully in other complex socio- technical industries such as the nuclear power and oil industry.

People such as Norman and Rasmussen have proposed other models of human error and failure. The attraction of the Reason, Latent Failure model is that it combines many of the good things present in the other models.

David O'Hare from Otago University has worked on cognitive failure analysis for aircraft accident investigation and has developed a six-step sequence of information processing. The CAA reviewed all this information and decided to include, in the database, the causal factors that follow what has now been termed "The Reason Model". The CAA also modified the model in the active failure area to align with the error conditions identified in the work carried out at Otago University.

'Norman's' model is essentially quite simple and is the basis for classifying the performance of unsafe acts in organisations The important thing to note about the 'Norman' model is the distinction made between *slips* and *mistakes*. A *slip* may be defined as an error performed by an individual or organisation where the right plan existed but the wrong action was executed. For example you planned to go to the supermarket on your way home from work but turned right instead of left and ended up at home quite unintentionally. A *mistake* may be defined as the wrong plan, correctly executed. For example you attached the spark plug leads to your car in the order 1324, as intended, but they should have been 1423. Knowing what sort of error or mistake has occurred can lead to different questions being asked about causes.

Generally it is mistakes that tend to be more expensive and dangerous. Mistakes can go undetected, particularly in complex systems, whereas slips are usually quite evident though not always.

Errors at different levels of behaviour

Rasmussen talks about **Skill based, Rule based** and **Knowledge based** behaviour.

Skill based behaviour relates to the automatic behaviours that one performs without conscious thought. Walking, driving a familiar route etc. Errors at this level tend to be 'strong but wrong'. This behaviour is governed by stored patterns of pre-programmed instructions. These errors will be associated with inappropriate behavioural combinations of space, time, and effort.

Rule based behaviours are merely behaviours that are exercised by the execution of stored rules that apply to partic ular situation. This behaviour enables familiar situations to be dealt with by learned rules (e.g., if 'this' state occurs then implement 'that' remedial action). Rule - based errors will be associated either with a misperception of situation demands, or the incorrect recall of appropriate procedures.

Knowledge based behaviours are used when an unusual situation is met. Such behaviour requires a considerable amount of effort and can result in very wrong decisions being made where incomplete information is at hand. This behaviour is used do deal with completely novel situations to which no actions have been pre-

planned. Knowledge-based errors will result from limitations in operator resources, or from incomplete or incorrect knowledge.

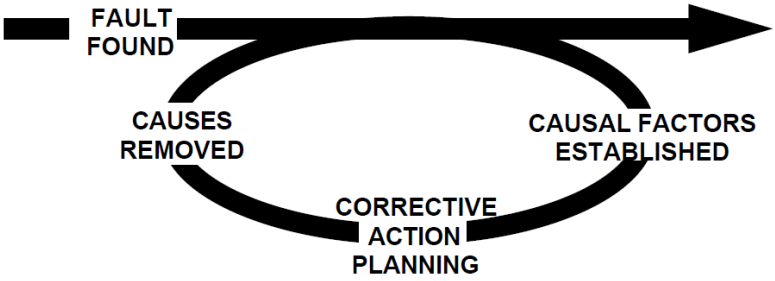
These models of behaviour can also apply to organisations.

The models represent just some of the ways of thinking about everyday discrepancies that one observes within organisations and human behaviour.

The system described in this Advisory Circular is one method of bridging the gap from academic knowledge to a practical working management information tool.

The Safety Control System

The design of the Civil Aviation Authority's system for the measurement, evaluation and correction of detected deficiencies is based on the concept of a Quality Control (QC) loop. The QC loop is a well-known and accepted quality management tool that is used by organisations to measure, control and improve their processes. The Authority is responsible for the measurement, control and improvement of aviation safety across the entire Mongolian aviation industry. The QC loop principle can be used in the Authority's management of aviation safety. From the Authority's perspective the QC loop can be termed a safety control loop depicted below at Diagram 3.



Safety Control Loop

Diagram 3

The Authority continuously monitors identified safety parameters within the Civil Aviation environment.

From the reactive perspective the CAA monitors occurrences such as accidents, incidents and defects that are notified from external sources. When a deficiency is detected by safety audit, or an occurrence is notified to the Authority, the sequence of events initiated are those described by the safety control loop. In these cases the causal factors, or reasons, for the fault need to be determined, corrective action planning undertaken and the causes of the fault removed by implementation of the corrective action. The Safety Control Loop Process is a control mechanism that not

only involves the identification and measurement of faults but also involves the planning and implementation of corrective actions. When applied to an organization the loop provides the necessary dynamic feedback to provide management with confidence that safety objectives are being met. The loop also provides management with a mechanism to ensure the continual improvement of safety.

Deficiencies may also be detected by analysis of collective information that has been received and recorded over a period of time. This trend information can indicate causal factors that may not be apparent by simply looking at individual events. The correction of these types of faults follows exactly the same sequence on the safety control loop. The CAA can compare these general failure type profiles as depicted in Diagram 4, and carry out Pareto analysis to determine which areas of the system are having particular problems. Suitable corrective action programs can then be devised. Resources are targeted to the areas of maximum potential safety benefit and the results are monitored for an improvement in safety performance.

General Failure Type (GFT) profiles

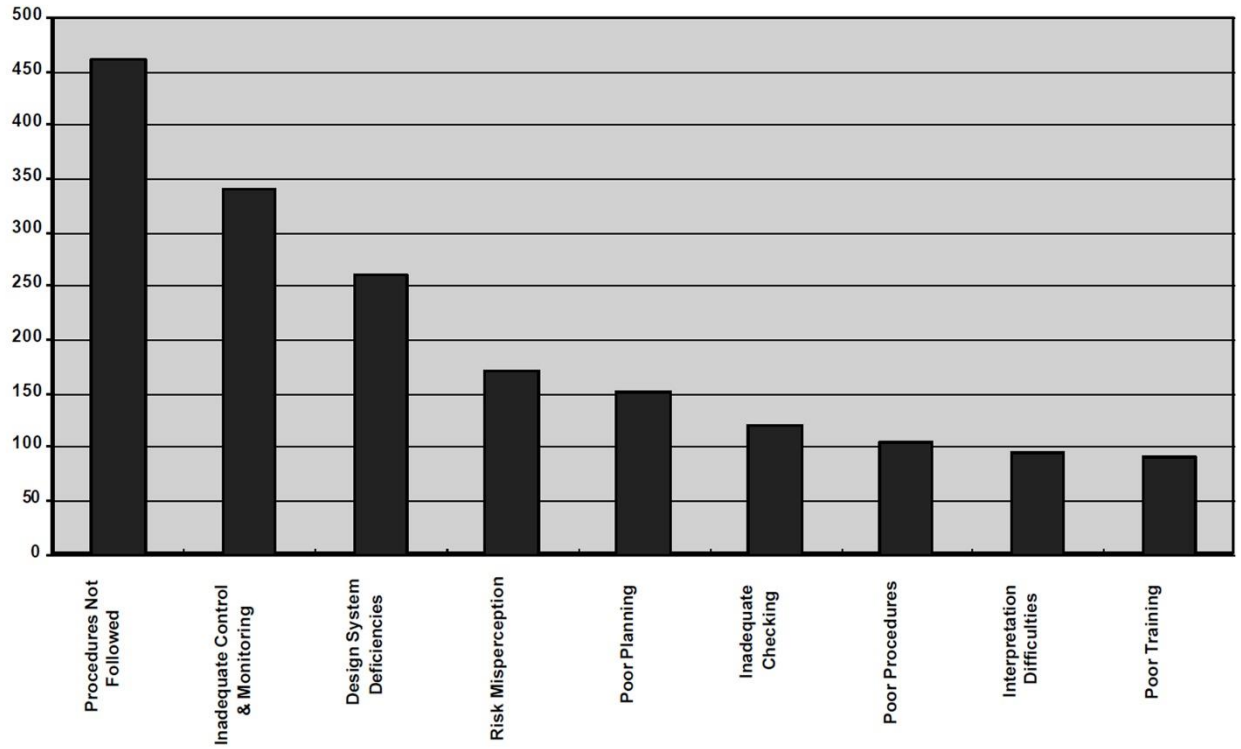


Diagram 4

For every fatal accident there are at least 600 incidents. Incidents are therefore a rich source of information for understanding problem areas within an organisation. These incidents are the free lessons that did not fully penetrate the system's safety defences. Organisations may improve their safety performance by taking this pro-active approach to identifying the latent failures that exist in all organisations. Many learned commentators have described how improved safety performance aligns with improved financial performance. This pro-active ability within the industry environment is essential if there is to be a major impact on the accident rate.

The CAA have written the new rules to encompass the use of management quality systems, including the requirements to put in place procedures for identifying causal factors stemming from internal audits and safety investigations into company incidents. We have not mandated which method of causal factor identification methodologies should be used (there are a number available). However, the methods promulgated by ICAO and this AC are acceptable means of compliance.

ICAO Human Factor Digests

Suggested reading

The following ICAO Human Factors Digests contain detailed information on how the Latent Failure Model works.

Circular 240 - AN/144	No. 7	Investigation of Human factors in Accidents and Incidents
Circular 247 - AN/148	No. 10	Human Factors Management and Organisation
Circular 253 - AN/151	No. 12	Human Factors in Aircraft Maintenance and Inspection

--oOo--