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safety behaviours

WORKBOOK FOR PILOTS

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ISBN 978-1-921475-07-8

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The Civil Aviation Safety Authority is responsible for the safety regulation of Australia's civil aviation operators, and for the regulations of Australian-registered aircraft outside Australian territory.

safety behaviours
WORKBOOK FOR PILOTS

Welcome to the *Safety Behaviours: Workbook for Pilots*, which provides you with a number of practical exercises and accident case studies to support your understanding of the theory in the *Safety Behaviours: Human Factors for Pilots Resource Guide*. For some of you this may be your first exposure to these exercises; others may wish to use them as a refresher. This workbook has been developed to provide a stronger focus on the needs of the Australian aviation environment generally, and low capacity regular public transport and charter operations, flying training organisations and private operators in particular.

While the workbook contains a number of practical exercises, you may already have your own practical techniques for dealing with the various human factors areas covered in this package (e.g. fatigue management, stress, communication etc). Where possible, you should take any existing practical techniques or exercises and use them to highlight better management of the various human factors which may degrade performance and lead to human errors. While we cannot eliminate human error, a thorough understanding of human factors principles can lead to the development of appropriate policies, strategies and practical tools to mitigate its adverse impact on aviation safety.

We hope you find the exercises in the *Safety Behaviours: Workbook for Pilots* useful in furthering your understanding of this important area.

CONTENTS

Figures

Tables

Overview

This workbook contains a number of practical exercises and further case studies to reinforce your understanding of various human factors issues.

It also provides further opportunity to reflect on the 'Airtime' drama and to list strategies that could help you to improve how you manage various human factors.

Answers to various exercises can be found on page 107 of this workbook.

It is recommended you read the *Facilitator's Guide* prior to commencing any of these activities. The *Facilitator's Guide* provides the logical structure and guidance on how to progress through this training package:

If you are having any trouble, please refer to the contacts on page 2 of this workbook.

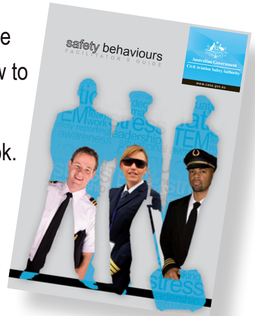


Table 1 Overview of modules

Chapter	Instructions	Completion
1: Introduction	▪ Read the *Resource Guide* chapter 1 Introduction (page 6) ▪ Read the workbook overview and chapter 1 (pages 6 and 9) ▪ Open the workbook to Exercise 1 (page 10) ▪ Play the DVD 'Introduction' and 'Airtime' ▪ Complete workbook Exercises 1 and 2 ▪ Play the DVD 'What the experts say' ▪ Discuss with peer, mentor or tutor	Module completed? ☐
2: Fatigue	▪ Read the *Resource Guide* chapter 2 (page 18) ▪ Work through the workbook exercises, chapter 2 (page 19) ▪ Play the DVD 'Strategies Page 1', 'Introduction' and 'Fatigue' ▪ Discuss with peer, mentor or tutor	Module completed? ☐
3: Stress	▪ Read the *Resource Guide* chapter 3 (page 36) ▪ Work through the workbook exercises chapter 3 (page 24) ▪ Play the DVD 'Strategies Page 1' and 'Stress' ▪ Discuss with peer, mentor or tutor	Module completed? ☐
4: AOD	▪ Read the *Resource Guide* chapter 4 (page 48) ▪ Work through the workbook exercises chapter 4 (page 33) ▪ Play the DVD 'Strategies Page 1' and 'Alcohol and other drugs' ▪ Discuss with peer, mentor or tutor	Module completed? ☐
5: Communication	▪ Read the *Resource Guide* chapter 5 (page 78) ▪ Work through the workbook exercises chapter 5 (page 41) ▪ Play the DVD 'Strategies Page 1' and 'Communication' ▪ Discuss with peer, mentor or tutor	Module completed? ☐
6: Teamwork	▪ Read the *Resource Guide* chapter 6 (page 94) ▪ Work through the workbook exercises chapter 6 (page 47) ▪ Play the DVD 'Strategies Page 1' and 'Teamwork' ▪ Discuss with peer, mentor or tutor	Module completed? ☐

Chapter	Instructions	Completion
7: Leadership	■ Read the *Resource Guide* chapter 7 (page 106) ■ Work through the workbook exercises chapter 7 (page 55) ■ Play the DVD 'Strategies Page 2' and 'Leadership' ■ Discuss with peer, mentor or tutor	Module completed? ☐
8: Situational Awareness	■ Read the *Resource Guide* chapter 8 (page 124) ■ Work through the workbook exercises chapter 8 (page 61) ■ Play the DVD 'Strategies Page 2' and 'Situational awareness' ■ Discuss with peer, mentor or tutor	Module completed? ☐
9: Decision Making	■ Read the *Resource Guide* chapter 9 (page 136) ■ Work through the workbook exercises chapter 9 (page 69) ■ Play the DVD 'Strategies Page 2' and 'Decision making' ■ Discuss with peer, mentor or tutor	Module completed? ☐
10: Threat and Error Management	■ Read the *Resource Guide* chapter 10 (page 146) ■ Work through the workbook exercises chapter 10 (page 81) ■ Play the DVD 'Strategies Page 2' and 'TEM' ■ Discuss with peer, mentor or tutor	Module completed? ☐
11: Airmanship	■ Read the *Resource Guide* chapter 11 (page 164) ■ Read the 'Teaching and Assessing Single-Pilot Human Factors and Threat and Error Management' publication ■ Work through the workbook exercises chapter 11 (page 87) ■ Play the DVD 'Strategies Page 2' and 'Airmanship' ■ Discuss with peer, mentor or tutor	Module completed? ☐
12: Safety Reporting	■ Work through the workbook exercises chapter 12 (page 97) ■ Play the DVD 'Strategies Page 2' and 'Safety Reporting' ■ Discuss with peer, mentor or tutor	Module completed? ☐

CASA Human Factors would like to hear about various strategies being used to overcome and address human factors issues. The aim is to collate and share this information across industry. We may even be able to provide you with some resources to help further improve your strategies.

Please contact us via the details on page 2 of this workbook.

When you are ready, please commence the exercises in chapter 1 of this workbook.

Chapter 1

Introduction to aviation safety investigation

This chapter provides a series of exercises demonstrating the application of system safety investigation techniques. The exercises will apply the Reason model of accident investigation, explained in greater detail later in the chapter, to a series of incidents arising from the 'Airtime' DVD.

EXERCISE 1: AIR SAFETY INVESTIGATION

It is assumed you have:

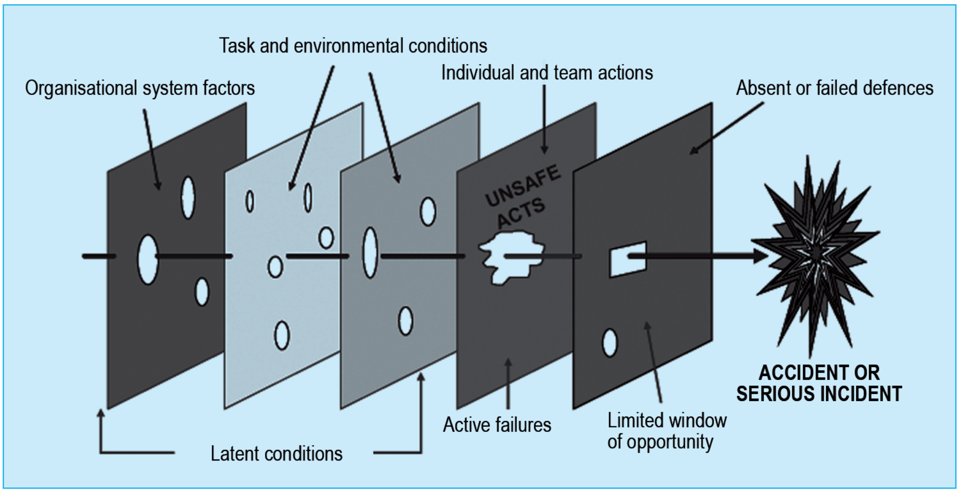
- Reviewed the *Facilitator's Guide*
- Read Chapter 1: Introduction of the *Resource Guide*

Play the DVD and select 'Introduction' then 'Airtime'. This drama runs for thirty minutes and follows the lives of two young pilots working for a low capacity regional airline. As you watch the drama make some notes below as to some of the reasons why Robert and Wilko find themselves in various predicaments.

Notes:

Let's now conduct an investigation into the series of incidents involving Robert and Wilko. In order to conduct a thorough investigation, we should use a model. Professor James Reason developed the following model, which is considered world's best practice for workplace incident and accident investigations:

Figure 1 The Reason model of accident causation



Active failures are individual/team actions (or inactions) which have an immediate adverse effect on safety and are generally viewed, with the benefit of hindsight, as *unsafe acts*. The model recognises that active failures occur within an operational context which includes *latent conditions*, such as poor equipment design, conflicting goals and poor organisational communication, which may be present long before an incident occurs and may combine with adverse task and environmental conditions, such as time pressure or adverse weather conditions, to promote errors and violations.

Contemporary accident and incident investigations are unlikely to end with the identification of 'sharp end' active human failures, as undetected latent conditions have the potential to contribute to the occurrence of many incidents and accidents.

For example, consider an incident resulting from an individual violating a normal procedure to 'get the job done' eg. using an undocumented procedure when working around aviation fuel. In isolation, one may assume that this act alone is the cause of the incident, resulting in the individual being punished and the investigation closed. But, what if the workplace had poorly documented procedures for completing the task and a slow process for amending and updating these procedures? Additionally, what if the lighting in the workplace was poor (eg. badly lit hangar) and the equipment was old and difficult to use, making the task even more difficult? Let's also assume that the organisation was aware the procedure was inadequate but could not allocate sufficient resources to provide an adequate amendment system, could not provide new equipment for conducting the task or improved lighting for the hangar. Let's now assume senior management were aware of the problems but encouraged completion of the task to get the job done.

This behaviour was reinforced over many years and the task was completed a particular way because 'that's the way we've always done it'. Eventually, it became known that the documented policy was not the way to complete the task and the cultural norm, reinforced over time, was to violate the published procedure. At all levels this was considered appropriate practice.

Focusing on the unsafe act of the individual would not prevent reoccurrence of the incident. The organisational (or latent) conditions in which poorly documented procedures and a system that was slow (if not impossible) to update procedures, combined with environmental conditions (poor lighting in the workplace and inadequate equipment) to produce a serious incident. As latent conditions greatly increase the opportunity for errors and violations to occur, the investigation should identify the latent conditions (poor procedures, cultural norms, workplace conditions) if the safety system is to prevent the same event happening again.

Typically there will always be latent conditions within any organisation and it is not acceptable for individuals to simply blame the system for the failures. This search for latent conditions must also be balanced against the principle of a *just culture* i.e. a culture where there is a clearly established line between acceptable and unacceptable behaviour and individuals can and should be accountable for violations if they could have been expected to know better. Each and every person within an organisation must pro-actively search and seek to implement improvements within the workplace at all times, particularly those related to identification of threats, hazards and management of error.

Question 1:

Working backwards from the accident, the investigator must first consider what *defences* failed or were inadequate to prevent the event or series of events? Defences guard against errors or violations having serious safety consequences. There are usually multiple defences within any system and these are barriers or safeguards to protect against errors and can range from "hard" engineered safety devices (i.e. seatbelts, electronic warning and detection systems) to "soft" defences such as standard operating procedures or staff awareness via education or training programs.

Example

In 'Airtime', Rover Airlines did not have a clear policy and procedure for secondary employment, meaning that pilots like Wilko could work another job, without considering the safety consequences of fatigue.

What are the other failed defences that you can identify within Rover Airlines?

Use the following investigation chart (table 2) to record the absent or failed defences.

Table 2 Reason model analysis chart

Organisational factors	Task or environmental conditions	Individual or team actions	Absent or failed defences

Question 2:

The second question involves looking at the individual/team actions (errors or violations). These are the actual errors or violations committed by the people at the time of the incident. For example:

- Forgetting a crucial step in a procedure
- Misdiagnosing a problem state
- Breaking a work-related rule or procedure.

Example

In 'Airtime', Wilko forgets to check that the pitot tube cover has been removed as part of his pre-flight checks.

What are the other individual/team actions that you can identify?

Use the investigation chart (table 2) to record your answers.

Question 3:

Third, the investigator must ask, what are the situational or environmental conditions that influenced people and led to the individual/team actions? These are called task/environment conditions. These are aspects of the task, equipment, environment or human limitations that increase the likelihood of, human errors. These error-producing conditions can include:

- High workload
- Unfamiliar tasks
- Excessive noise or temperature
- Personal or financial stress
- Lack of proficiency.

Example

In 'Airtime' Robert is suffering from fatigue and the operating captain gives him little time in which to obtain the NOTAM's. Robert's level of fatigue and the time pressure he is under are both conditions that directly lead to the errors (Robert later misses the information about the glider competition) made during the flight.

What are the other task/environment conditions that you can identify?

Use the investigation chart (table 2) to record your answers.

Question 4:

What are the organisational factors that led to the incident(s)?

Organisational Factors are 'normal' processes that are in every organisation, that are designed to manage risk. For example:

- Standard operating procedures
- Training
- Supervision
- Culture (safety versus commercial pressure).

Sometimes these organisational factors fail, and the role of the investigator is to determine how the organisation can better manage risk in the future.

Example

In 'Airtime' Rover Airlines did not have a clear policy or defined program to manage crew fatigue levels of their fitness for duty.

What are the other organisational factors that you can identify?

Use the investigation chart to (table 2) record your answers.

EXERCISE 2: RECOMMENDATIONS/STRATEGIES

Now that we have conducted an investigation into the series of incidents in 'Airtime', there is a need to identify:

- What are the safety recommendations that Rover Airlines should adopt to prevent these incidents from happening again?
- What would be some personal strategies that you would recommend to Wilko and Robert?

Note these down using the following table.

Table 3 List of safety recommendations and personal strategies

Safety recommendations for Rover Airlines	Personal strategies for the crew
Hint: Have a look at your Reason model analysis chart and ensure that your safety recommendations address all the absent/failed defences AND organisational factors that you have identified	**Hint**: Make sure all the individual/team actions that you have noted in your Reason model analysis chart are addressed.
Example: The airline should have a documented policy on secondary employment that is communicated to all pilots.	**Example**: As an operating crew member on overnight trips, my personal minimum would be to consume no alcohol to ensure I am fit for duty.

Safety recommendations for Rover Airlines	Personal strategies for the crew

Now that you have compiled a list of recommendations and strategies, let's see what the experts think! Play the 'What the Experts Say' part of the DVD and compare your suggestions to those from the experts. Now is the time to further discuss with a mentor.

You have now completed the introduction module. When you are ready, please read Chapter 2 of the *Resource Guide* (page 18)

Notes:

Chapter 2
Fatigue

This section provides some practical activities and exercises about fatigue and its management.

Make sure you have read the section on 'fatigue' in your *Resource Guide*.

EXERCISE 3: DRIVER FATIGUE QUIZ

While we're focusing on *pilot* fatigue, most of us actually drive to or from the airport. How much do you know about driver fatigue? Grab a pen and check.

Table 4 Driver fatigue quiz

Statements	True or false?
1. Coffee overcomes the effects of drowsiness while driving.	
2. I can tell when I'm going to go to sleep.	
3. Rolling down my window or singing along with the radio will keep me awake.	
4. I'm a safe driver, so it doesn't matter if I'm sleepy.	
5. You can stockpile sleep on the weekends.	
6. Most adults need at least seven hours of sleep each night.	
7. Being sleepy makes you misperceive things.	
8. Young people need less sleep.	
9. Wandering, disconnected thoughts are a warning sign of driver fatigue.	
10. Little green men in the middle of the road may mean the driver is too tired to drive.	
11. On a long trip, the driver should never take a break, but try to arrive at the destination as quickly as possible.	
12. A 'microsleep' lasts 3–5 seconds.	

Answers page 108.

EXERCISE 4: PILOT CHECKLIST - SYMPTOMS OF FATIGUE

Think of a recent flight in which you were an operating crew member. Complete the checklist of symptoms in the following table without deciding whether it was a factor during the flight.

Table 5 Symptoms of fatigue check

Symptoms	Yes or no
Lack of awareness - radio calls that go unanswered, or failing to complete checklists	
Diminished motor skills - sloppy flying, writing that trails off into nothing as weather reports or clearances are written down	
Obvious tiredness - drooping head, staring or half-closed eyes	
Diminished vision - difficulty in focusing	
Slow reactions	
Short-term memory problems - inability to remember a clearance long enough to repeat it back, or write it down accurately	
Channelled concentration - fixation on a single, possibly unimportant issue, to the neglect of others, and to the neglect of maintaining an overview of the flight	
Easy distraction by trivial matters, or the other extreme, fixation – either extreme could indicate fatigue	

Symptoms	Yes or no
Poor instrument flying - difficulty in focusing on instruments, fixation on one instrument to the neglect of others, drifting in and out of sleep, diminished motor skills with poor hand-eye coordination, and acceptance of lower standards	
Increased mistakes - errors, poor judgement and poor decisions or no decisions at all, even simple ones like 'Will I turn left or right to avoid this thunderstorm?'	
Abnormal moods - erratic changes in mood, depressed, periodically elated and energetic, diminished standards	

If you suffer from any of these symptoms, you may want to rethink your flight.

Remember: the only cure for fatigue is sleep

EXERCISE 5: 'AIRTIME' DISCUSSION

Consider the following scenarios in the 'Airtime' drama and discuss the following questions (You may want to replay the specific scenarios again to refresh your memory).

Scenario 1
Robert (Metro first officer) and a near mid air (START: 00:00 – END: 06:17)

Use the following discussion points as a guide:

- How did Robert's level of fatigue affect the safety of the operation?
- Does your organisation have a policy on fatigue? If so, what are your responsibilities as a crew member?
- At what stage should Robert have declared he was fatigued?
- How would you describe the level of support provided by John, the operating captain?
- Robert misses the updated NOTAMS information about the glider competition enroute to their destination airport. Use the following discussion points as a guide:
- How would you describe the interaction between John and Robert?
- Given the level of help provided by John to Robert, what options did Robert have to improve the situation?

Scenario 2
Wilko (Chieftain Pilot) arriving at work in a taxi (START: 06:18 – END: 08:12)

Use the following discussion points as a guide:

- What impact did Wilko's 'moonlighting' have?
- Does your organisation have a 'second-job policy'? If so, what are your responsibilities as a crew member?

- Wilko allowed himself to be distracted, and as a result missed an important pre-flight check. What could have happened if the chief pilot hadn't noticed the pitot tube cover was still in place?
- What barriers are there in your organisation to open discussion or reporting of fitness-for-duty issues, such as fatigue?

Now that you have discussed some of the issues from 'Airtime', make a list of any strategies you presently use (or could use) to minimise and mitigate the chance of a serious incident or accident resulting from either your own, or a colleague's, fatigue level:

Table 6 Your list of fatigue management strategies

Strategies to minimise the consequences of fatigue on performance

Now that you have identified your own strategies, let's find out what the experts think. Play the DVD and select 'Strategies page 1', 'Introduction' then 'Fatigue'. Continue to make further notes in the above table. Discuss with mentor or peer.

You have now completed the fatigue module. When you are ready, please read Chapter 3 of the *Resource Guide* (page 36)

Notes:

Chapter 3
Stress

This section provides some practical activities and exercises about stress and its management.

Make sure you have read the section on ‘stress’ in your *Resource Guide*.

EXERCISE 6: 'SELF-IMPOSED PRESSURE?'

At about 1930 Western Standard Time on 26 January 2001, a Cessna 310R aircraft (VH-HCP), departed Kiwirrkurra, Western Australia (WA), for Newman. The flight was conducted at night under visual flight rules (VFR), with one pilot and three passengers on board.

The aircraft, part of the Air Support Unit of the WA Police Service, had been used to transport police officers from Newman to Kiwirrkurra earlier that day. The aircraft arrived in the circuit area at Newman at about 2150 for a landing on runway 23. Witnesses at the aerodrome heard the engines start to 'cough and splutter'. Soon after, the aircraft collided with the ground about 3 km to the east of Newman aerodrome. The four occupants sustained fatal injuries. Impact forces destroyed the aircraft.

Image courtesy of ATSB

The investigation determined that both of the aircraft's engines failed due to fuel starvation, prior to impact with the ground. There was no evidence of a technical malfunction or an in-flight fuel leak. From the information available, the investigation calculated that the aircraft probably had about 165 litres of useable fuel at impact. Approximately 30 litres of fuel was recovered from the aircraft's auxiliary fuel tanks and it was probable that fuel had leaked from these tanks post-impact.

Pressure and stress

The investigation considered the pressure that the pilot was under to conduct the return flight to Newman, given the specific circumstances and conditions that existed on the day of the accident. The investigation report found that "the requirement for police to attend Kiwirrkurra resulted from a serious incident requiring urgent police attendance. It is possible that the seriousness of the situation had influenced the pilot's pre-flight preparation and the decision to depart Karratha without obtaining relevant pre-flight briefings.

A number of other issues may also have had an influence on the pilot's decision to conduct the return flight that night. For example:

Due to the lack of commercially available accommodation at Kiwirrkurra and because they did not have their own bedding material or food for an overnight stay, the officers may have been reluctant to delay their departure until the next day, despite the offer of accommodation in a private residence.

During aspects of the dispute resolution there had also been tension with members of the local community. That aspect may have also influenced the officers' desire to depart Kiwirrkurra.

The pilot had only recently moved to Karratha. At such an early stage of his appointment, he may have been trying to create a positive impression and accordingly, could have been reluctant not to complete the flight back to Newman, particularly as that would have entailed a degree of inconvenience for the passengers.

The investigation did not find evidence of any overt pressure on the pilot to complete the return flight that night. However, there were potential sources of self-imposed pressure that could have influenced the pilot's decision to undertake the flight back to Newman.

Based on information obtained during the investigation, the investigation concluded that the pilot was probably experiencing self-imposed pressure to conduct the flight.

Discussion:

What factors may have influenced the crew of VH-HCP to operate the return flight?

Have you experienced any similar pressures, and if so, how have you dealt with the situation?

EXERCISE 7: FLIGHT FITNESS TEST

A Go/No-Go decision is made before each flight. Pilots should not only pre-flight check the aircraft, but also themselves on each and every flight.

Before every flight, you should ask, 'Could I pass my medical examination right now?' If you cannot answer with an absolute 'Yes', then the reality is, you should not fly.

The following checklist is intended for a pilot's personal pre-flight use. You may wish to carry a copy in your flight bag and onboard the aircraft.

Table 7 Personal flight fitness test

Question	Yes or no
Do I feel well? Is there anything wrong with me at all?	
Have I taken any medication in the last 12 hours?	
Have I had as little as one ounce of alcohol in the last 8 hours?	
Am I tired? Did I get a good night's sleep last night?	
Am I under undue stress? Am I emotional right now?	
Have I eaten a sensible meal and taken in a good load of protein? Do I have a protein snack, such as cheese, meat or nuts, aboard?	
Am I dehydrated? Do I need to take noncarbonated liquids such as water or fruit juices?	
Am I equipped with sunglasses, ear protectors, appropriate clothing?	

EXERCISE 8: STRESSFUL LIFE EVENTS

How stressed do you think you are?

This quick quiz may make you more aware of the impact of significant life events on your level of stress. The following table lists a number of life events that the average person could reasonably expect to experience during their lifetime.

To test yourself, just go through the list and add up the points of the events that have happened to you in the last year. Total up the points allocated to each of these events in the right hand column to get your total cumulative score.

Table 8 Significant life event score

Life event	Score	Cumulative score
Death of spouse	100	
Divorce	60	
Menopause	60	
Separation from living partner	60	
Jail term or probation	60	
Death of close family member other than spouse	60	
Serious personal injury or illness	45	
Marriage or establishing life partnership	45	
Fired at work	45	
Marital or relationship reconciliation	40	
Retirement	40	
Change in health of immediate family member	40	
Work more than 40 hours per week	35	
Pregnancy or partner becoming pregnant	35	
Sexual difficulties	35	
Gain of new family member	35	
Business or work role change	35	
Change in financial state	35	
Death of a close friend (not a family member)	30	
Change in number of arguments with spouse or partner	30	
Mortgage or loan for a major purpose	25	
Foreclosure of mortgage or loan	25	
Sleep less than 8 hours per night	25	
Change in responsibilities at work	25	
Trouble with in-laws, or with children	25	
Outstanding personal achievement	25	
Spouse begins or stops work	20	
Begin or end school	20	
Change in living conditions (visitors in the home, change in roommates etc.	20	
Change in personal habits (diet, exercise, smoking, etc.)	20	
Chronic allergies	20	
Trouble with boss	20	
Change in work hours or conditions	15	
Moving to new residence	15	
Presently in pre-menstrual period	15	
Change in schools	15	
Change in religious activities	15	
Change in social activities (more or less than before)	15	

Life event	Score	Cumulative score
Minor financial loan	10	
Change in frequency of family get-togethers	10	
Have been or are about to go on holiday	10	
Presently in Christmas seasons	10	
Minor violation of the law	5	
Total score		

Adapted from the "Social Readjustment Rating Scale" by Thomas Holmes and Richard Rae.
This scale was first published in the "Journal of Psychosomatic Research", Vol.II (2), 1967, p. 214.

What your score means

Each of us has personal stress-adaption limitations. When we exceed this level, stress overload may lead to poor health or illness. Although different people have different capacities to cope with stress, for the average person, a score of 250 points or greater may indicate that you are suffering from high levels of stress.

Studies revealed that people who had become ill had accumulated a total of 300 stress points or more in a single year. You were asked to look at the last twelve months of changes in your life. It is important to understand that 'ripples of stress' can circulate a long time after the actual change has taken place.

High stress levels will adversely affect your immune system and lead to mental or physical illness if something is not done about it. It is very important to lighten your stress load and develop mechanisms to cope with the stress before something gives.

The message for flight crew is clear. If stress brought on by life events is not well managed, and is added to the stress of operating an aircraft, your performance might be affected.

EXERCISE 9: 'AIRTIME' DISCUSSION

In the 'Airtime' drama discuss the following questions.

- What stressors was Robert under?
- What stressors did Wilko experience?

Now that you have discussed some of the issues from 'Airtime', make a list of any strategies you presently use (or could use) to minimise and manage your stress levels.

Table 9 Your list of stress management strategies

Strategies to minimise the consequences of stress on performance

Now that you have identified your own strategies, let's find out what the experts think. Play the DVD and select 'Strategies page 1' and 'Stress'. Continue to make further notes within the preceding table.

You have now completed the stress module. When you are ready, please read Chapter 4 of the *Resource Guide* (page 48)

Notes:

Notes:

Chapter 4

Alcohol and other drugs (AOD)

This section provides some practical activities and exercises about the responsible use of alcohol and other drugs.

Make sure you have read the section on 'alcohol and other drugs' in your *Resource Guide.*

As a result of a fatal accident on Hamilton Island in 2004, the Australian Transport Safety Bureau recommended that the Department of Transport and Regional Services and the Civil Aviation Safety Authority (CASA) jointly examine the safety benefits of a testing regime for alcohol and other drugs in the aviation sector. The AOD testing component of the initiative covers all safety-sensitive personnel, including those not covered by the Drug and Alcohol Management Plan scheme. In addition to Air Operator Certificate and Certificate of Approval holders, private pilots, contractors and all others undertaking safety-sensitive aviation activities will be subject to random testing. The aim of the initiative is to minimise AOD-related risks associated with the performance of safety-sensitive activities in the aviation industry.

EXERCISE 10: TEST YOUR ALCOHOL IQ

Take this simple test to find out how much you really know about alcohol.

Table 10 Your knowledge of alcohol

Statement	True or false?
1. A 12-ounce beer, a 4-ounce glass of wine and a 1-ounce shot of whiskey all contain the same amount of alcohol.	
2. A couple of drinks before bed improves sleep quality.	
3. Women react differently to alcohol than men, and generally can expect greater impairment from the same quantity of alcohol.	
4. Pilots change their drinking patterns when away on a duty.	
5. Modest amounts of alcohol don't affect your flying.	

Extracted from: Newman, D., 1999, 'How much is too much?', *Flight Safety Australia,* July - August, 43-44, Civil Aviation Safety Authority, Canberra.

EXERCISE 11: HOW RISKY IS YOUR DRINKING?

The most widely used screen for alcohol use in Australia is the AUDIT (Alcohol Use Disorders Identification Test). AUDIT is used consistently by Australian health professionals to assist them to make decisions about appropriate treatment options for individuals using alcohol in excess of low risk levels. You can complete the AUDIT below to work out your level of risk. The AUDIT was developed and validated by the World Health Organisation (1989).

NOTE: this is for your personal reference only as a self-report measure, so please answer the questions honestly for a valid score.

Simply select the option that describes your answer and place in the SCORE box (eg. for Question 1 if your answer is 2 - 4 times per month – place a 2 in the SCORE box).

Table 11 The alcohol use disorders identification test (audit)

Questions	0	1	2	3	4	Score
1. How often do you have a drink containing alcohol?	Never	Monthly or less	2 - 4 times a month	2 - 3 times a week	4 + times a week	
2. How many standard drinks containing alcohol do you have on a typical day when you are drinking?	1 - 2	3 - 4	5 - 6	7 - 9	10 or more	
3. How often do you have six or more standard drinks on one occasion?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
4. How often during the last year have you found that you were not able to stop drinking once you had started?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
5. How often during the last year have you failed to do what was expected of you because of drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
6. How often during the last year have you needed a drink in the morning to get yourself going after a heavy drinking session?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
7. How often during the last year have you had a feeling of guilt or remorse after drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
8. How often during the last year have you been unable to remember what happened the night before because of your drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
9. Have you or someone else been injured because of your drinking?	No		Yes, but not in the last year		Yes, during the last year	
10. Has a relative, friend, doctor or other health care worker been concerned about your drinking or suggested you cut down?	No		Yes, but not in the last year		Yes, during the last year	
Total						

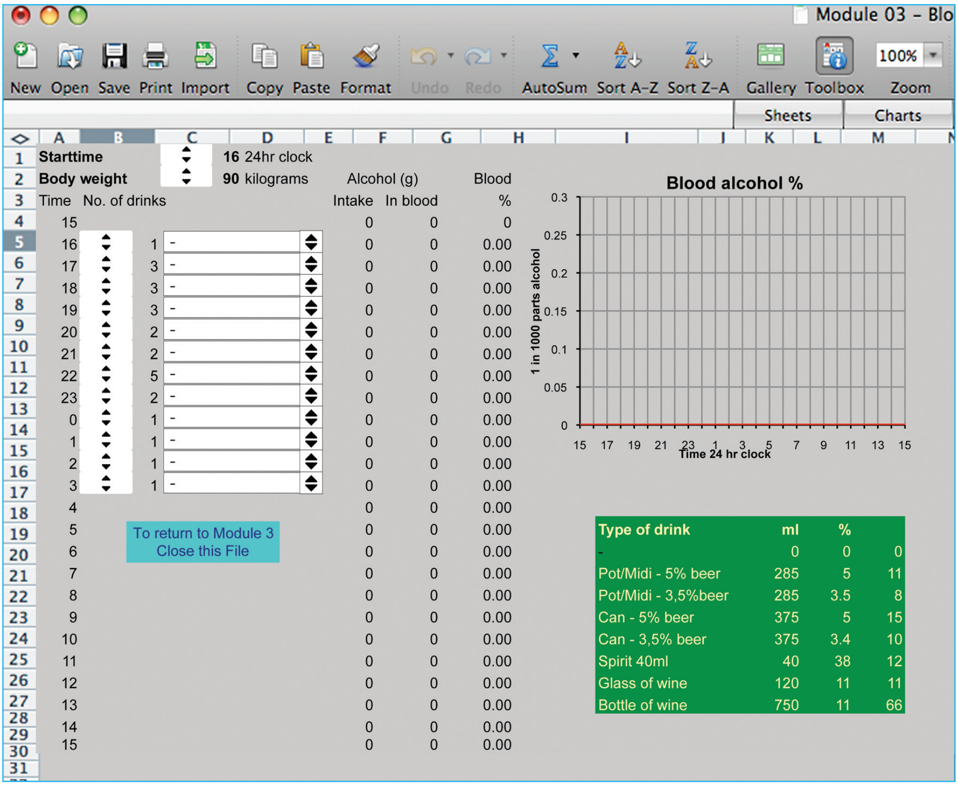
How to score the audit

Questions 1-8 are scored 0, 1, 2, 3, or 4 as indicated in the top row. Questions 9 and 10 are scored 0, 2, or 4 only. If your score is 0-7: Congratulations - your alcohol consumption is low-risk. If you scored 8 or more: You are drinking in excess of low risk levels and might benefit from speaking to your GP or other health professional about ways to cut down your drinking.

Alcohol consumption and metabolism spreadsheet

A spreadsheet is provided within the CD (as shown below) that can be used to determine the amount of time the human body takes to metabolise alcohol. Double click on the spreadsheet and you will be able to enter a number of criteria into the drop-down menus and determine from the graphed red line the time taken for your body to metabolise your intake of alcohol. Take the time to explore the spreadsheet and your body's ability to metabolise alcohol, you might be surprised at the remaining levels of alcohol following drinks the previous night and the safety implications while flying.

Figure 2 Blood alcohol consumption and metabolism spreadsheet



Quick tips for cutting down

- Identify good reasons for cutting down.

  Think of some good reasons for reducing your AOD consumption. These reasons might include losing weight, avoiding hangovers, having a clearer head and better memory, or minimising relationship problems. Choose some reasons that make sense to you, and write them down (perhaps in your diary) so that you can refer to them later on.

- Set some goals.

  Pick a day when you plan to start cutting down and set your daily consumption goals each week. Then record your consumption, in a diary, to help work out whether you're on track to meet your goals. If you don't achieve your goals, work out some practical strategies to help you next time.

- Be aware of high-risk times.

  There will be times when you will find cutting down difficult, no matter how much you want to change. Common high-risk times might be after work, at a party, watching sports events, or when you feel lonely, stressed or depressed. Think of some high-risk times for you, and write them down in the place where you have recorded your reasons for cutting down.

- Manage the high-risk times.

  Now that you have identified your high-risk times you need to work out how to manage them and deal with the situation. Some ways of coping with high-risk times might include planning to do other things at times when you would usually use AOD, making sure you eat before drinking, alternating non-alcoholic drinks with alcoholic drinks, or just avoiding high-risk places and people. Think now about practical and sensible ways to deal with the high-risk times that you wrote down at step 3. Then, on a daily basis, think about each of your high-risk times and imagine how you will manage those times using these ideas.

- Identify someone you trust to support you.

  Often people find it is easier to cut down if they have someone they can talk to and be honest with who supports them and their decision. This person might be your partner, a friend, or perhaps a colleague who also wants to cut down. Your doctor or other health professionals can also support you.

- Stick to your goals.

  Some habits are difficult to break. Using the tips here in this section will help you. Talk to your support person to help you get through the times when you are finding it hard to stick to your goals. Each time you stop yourself from doing something by habit you are another step closer to breaking that habit altogether. Your cravings will pass more easily if you're occupied doing something else.

EXERCISE 12 - 'AIRTIME' DISCUSSION

Consider the following scenarios in the 'Airtime' drama and discuss the following questions (You may want to replay the specific scenarios again to refresh your memory).

Scenario 3

Robert takes medication for a headache and cold (START: 08:13 – END: 15:15)

Robert takes some strong pain medication to treat a severe headache prior to his flight as an operating crew member. Use the following discussion points as a guide:

- Are you aware of the medications you can and can't take prior to a flight as an operating crew member? Discuss what is 'approved'.
- Have you ever taken a mixture of non-prescription medication without knowing of what the combined effects may be?
- If you are not sure about your physical fitness to fly and any prescription or non-prescription medication you may be taking, what course of action would you take?
- How do you manage times of higher stress e.g. balancing family commitments and work? What are your strategies to deal with situations like this?

Scenario 4

Wilko (Chieftain Pilot) enjoys a beer (START: 15:16 – END: 20:05)

On an overnight flight Wilko consumes a quantity of alcohol, retires to bed late and awakes with a hangover. Use the following discussion points as a guide:

- Does your organisation have a policy on the responsible use of alcohol? If so, what are your responsibilities as a crew member?
- Are you aware of the Civil Aviation Regulations stipulating responsible alcohol usage as a pilot? What are your responsibilities as a licensed pilot?
- Are you aware of the CASR Part 99 Alcohol and Other Drugs testing regime and are you familiar with your company's Drug and Alcohol Management Plan?
- Have you knowingly made poor decisions that have compromised your performance and what lessons did you learn from these experiences (for example sterile cockpits and distractions)?

Now that you have discussed some of the issues from 'Airtime', make a list of any strategies you presently use (or could use) for the responsible use of alcohol and other drugs.

Table 12 Your list of alcohol and other drug management strategies

Strategies to minimise the consequences of alcohol and other drugs on performance

Now that you have identified your own strategies, let's find out what the experts think. Play the DVD and select 'Strategies page 1' then 'Alcohol and other drugs'. Continue to make further notes in the above table. Discuss with mentor or peer.

You have now completed the alcohol and other drugs module. When you are ready, please read Chapter 5 of the *Resource Guide* (page 78)

Notes:

Chapter 5
Communication

This section provides some practical activities and exercises about effective communication in the aviation industry.

Make sure you have read the section on 'communication' in your *Resource Guide*.

EXERCISE 13: WHICH ENGINE?

An applied example of communication issues impacting on an accident sequence can be seen in the case study below. The details of the accident illustrate how communication issues from several perspectives were identified as contributing factors. Not only was vital information not passed on to the flight crew, but their management of an in-flight emergency was affected by competing radio transmissions from air traffic control.

After reading the following accident summary, conduct a group discussion about the specific communication errors that were made during this accident sequence. (Hint: remember to focus outside of the cockpit).

British Midland Airways - Flight 092 (Boeing 737), Kegworth, UK. 8 January 1989 (Fatalities - 47: 126)

Accident Summary

The aircraft was a British Midland 737-400, tail number G-OBME, on a scheduled flight from London Heathrow Airport to Belfast, Northern Ireland, having already flown from Heathrow to Belfast and back that day. After taking off from Heathrow at 7:52pm, Flight 92 was climbing through 28,300 feet to reach its cruising altitude of 35,000 feet when one of the fan blades on the left engine suddenly ruptured. While the pilots did not know the source of the problem, a pounding noise was suddenly heard, accompanied by severe vibrations.

In addition, smoke poured into the cabin through the ventilation system and an aroma of burning entered the plane. Several passengers sitting near the rear of the plane noticed smoke and sparks coming from the left engine.

The flight was diverted to the East Midlands Airport, which was only a few minutes' flight away and reachable with only one engine. After the initial blade fracture, the captain, Kevin Hunt, had disengaged the plane's autopilot. When Hunt asked the first officer, David McClellan, which engine was malfunctioning, McClellan replied: 'It's the le... it's the right one'.

In previous versions of the 737, the air conditioning ran through the right hand engine, but on the 737-400 it ran through both. The pilots had been used to the older version of the aircraft and did not realise that this aircraft (which had only been flown by British Midland for 520 hours over a two-month period) was different.

When they smelt the smoke they assumed it was coming from the right engine; this led them to shut down the working right engine instead of the malfunctioning left engine. They had no way of visually checking the engines from the cockpit, and the cabin crew did not inform them that smoke and flames had been seen from the left engine.

When the pilots shut down the right engine, they could no longer smell the smoke, which led them to believe that they had correctly dealt with the problem. As it turned out, this was simply a coincidence.

When the auto-throttle was disengaged to shut down the right engine, the fuel flow to the left engine was reduced and the excess fuel which had been igniting in the jet exhaust disappeared; therefore, the ongoing damage was reduced, the smoke smell ceased, and the vibration reduced, although it would still have been visible on cockpit instruments.

During the final approach to Runway 27 at East Midlands Airport, more fuel was pumped into the damaged engine to maintain speed, which caused it to cease operating entirely and burst into flames. The captain attempted to restart the right engine by windmilling, using the air flowing through the engine to rotate the turbine blades and start the engine, but the aircraft was by now flying too slowly for this.

The captain managed to keep the now-gliding aircraft airborne long enough to avoid a crash landing in the village of Kegworth by pointing the nose up and stretching the glide, but just before crossing the M1 motorway, the tail hit the ground and the aircraft bounced back into the air and over the motorway, crashing on the opposite embankment and breaking up into three pieces (just 900m short of the runway).

Casualties

Forty-seven of the 118 passengers (126 people on board including flight staff) died (39 at the scene, eight later). All eight of the flight crew survived the accident. Of the 79 survivors, five had minor injuries and 74 were seriously injured. No one on the motorway was hurt (and no vehicles were damaged).

Image courtesy of Safetywise

Shutting down the wrong engine

The captain (Kevin Hunt) believed the right engine was malfunctioning due to the smell of smoke, because in previous Boeing 737 variants, bleed air for the air conditioning system was taken from the right engine. However, starting with the Boeing 737-400 variant, Boeing redesigned the system to use bleed air from both engines. Several cabin staff and passengers also noticed that the left engine had a stream of unburnt fuel igniting in the jet exhaust, but this information was not passed on to the flight crew, because they thought that the pilots knew what they were doing.

Besides the unfortunate coincidence of the smoke disappearing when the autothrottle was disengaged to shut down the right engine, the pilots may have established a habit of disregarding the readings of vibration warning meters - early versions were unreliable but the flying crew of G-OBME did not seem to have been aware that newer ones were more reliable. The dials were also smaller than on the previous versions of the 737 in which they had the majority of their experience.

The pilots had received no simulator training on the new model, as no simulator for the 737-400 existed in the UK at that time.

Official investigation findings

“The operating crew shut down the No 2 engine after a fan blade had fractured in the No 1 engine. This engine subsequently suffered a major thrust loss due to secondary fan damage after power had been increased during the final approach to land.

The following factors contributed to the incorrect response of the flight crew:

- The combination of heavy engine vibration, noise, shuddering and an associated smell of fire were outside their training and experience;
- They reacted to the initial engine problem prematurely and in a way that was contrary to their training;
- They did not assimilate the indications on the engine instrument display before they throttled back the No. 2 engine;
- As the No. 2 engine was throttled back, the noise and shuddering associated with the surging of the No. 1 engine ceased, persuading them that they had correctly identified the defective engine;
- They were not informed of the flames which had emanated from the No.1 engine and which had been observed by many on board, including 3 cabin attendants in the aft cabin".

Group discussion

The official accident investigation report mentioned several specific issues in relation to communication.

Discuss your views of the communication errors in small groups.

EXERCISE 14: ARE YOU A GOOD LISTENER?

Try the questions below to see whether you are a good listener.

Table 13 Are you a good listener?

Question	Yes or no
Do you tend to talk far more than other people?	
Do people say you speak too quickly?	
Do you often have to repeat what you said because you were thinking about something else?	
Do you tend to pose 'closed' questions requiring only 'yes' or 'no' as a reply?	
Do you often feel you know what somebody is going to say to you before they have finished talking?	
Do you often interrupt others when they are speaking?	
Is it difficult for you to recognise when you have made a mistake?	
Do you often state an opinion without thinking of how others will react?	
Do you feel satisfied when you have had the last word in a discussion?	
Do you find it difficult to calmly continue reasoning after being contradicted?	
Is it difficult for you to quickly name the person with whom you most worked with yesterday?	
Is it unusual for a co-worker to explain their difficulties to you and ask for advice?	

EXERCISE 15: 'AIRTIME' DISCUSSION

Were there any communication problems between any of the employees at Rover Airlines?

Can you identify any examples of effective communication in the 'Airtime' drama?

Now that you have discussed some of the issues from 'Airtime', make a list of any strategies you presently use (or could use) for improving the effectiveness of your communication:

Table 14 Your communication strategies

Strategies to improve the effectiveness of communication

Now that you have identified your own strategies, let's find out what the experts think. Play the DVD and select 'Strategies page 1' then 'Communication'. Continue to make further notes in the above table. Discuss with a mentor or peer.

You have now completed the Communication module. When you are ready, please read Chapter 6 of the *Resource Guide* (page 94)

Notes:

Chapter 6
Teamwork

This section provides some practical activities and exercises about teamwork in the aviation environment.

Make sure you have read the section on 'teamwork' in your *Resource Guide*.

EXERCISE 16: CREW CO-ORDINATION

Consider the following accident scenario and then discuss the flight crew co-ordination issues such as:

Overall flight crew co-ordination and discussion by the crew in relation to:

- The instrument approach procedure
- The missed approach procedure
- The required instrument call-outs
- The required course, fix and altimeter information

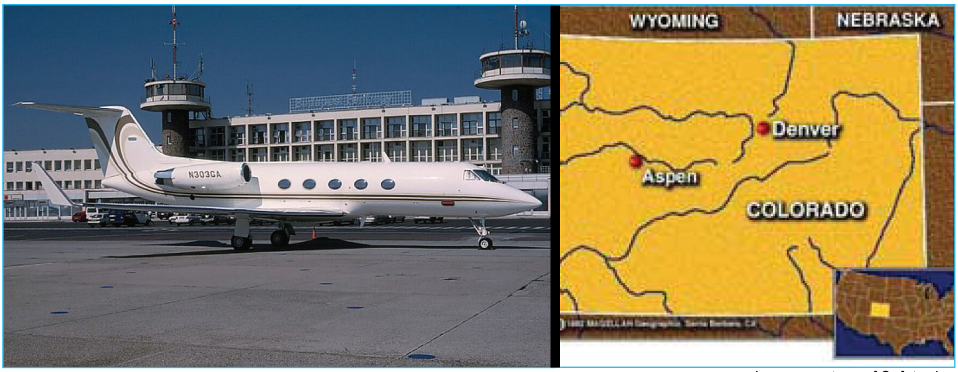


Image courtesy of Safetywise

Incident summary

On 29 March 2001, at approximately 1902, a Gulfstream III, N303GA, operated by Avjet Corporation, crashed into sloping terrain about 2400 feet short of Runway 15 at Airport Sardy Field (ASE), at Aspen, Colorado.

The three crewmembers and all 15 passengers were killed, and the aircraft was destroyed. The flight was operating as an on-demand passenger charter flight from Los Angeles International Airport (LAX), Los Angeles, California, to Airport Sardy Field.

Background/sequence of events

The aircraft entered the Aspen terminal area about 1843. According to the cockpit voice recorder (CVR) recording, the flight crew had been planning a visual approach to Runway 15, however, as the aircraft descended toward the airport, clouds and snow showers increased, obscuring the field.

The automatic terminal information service in effect during the final approach indicated that the weather conditions were wind 250º at 3 knots; visibility 10 miles; light snow; few clouds at 1,500 feet; broken cloud ceiling at 2,500 feet; and broken cloud ceiling at 5,000 feet. As the aircraft continued toward the airport, air traffic controllers provided arriving aircraft with vectors for the VOR/DME-C instrument approach procedure to the airport. At 1845, an aircraft executed a missed approach because of limited visibility. This was followed at 1853 by another aircraft also executing a missed approach.

About 1856, the accident aircraft was cleared for the VOR/DME-C approach course, and the captain was notified that visibility north of the airport had reduced to 2 miles. About 1858, a third aircraft executed a missed approach because the captain reported he could not see the airport.

At 1900:27, after the accident aircraft had passed the final approach fix, the captain of the accident aircraft asked the local controller, "Are the runway lights all the way up?" The local controller stated," Affirmative, they're on high."

At 1900:43, the captain asked the first officer, "You see the runway?" and, at 1900:46, asked "You see the highway?" At 1900:49, the Aspen local controller asked the flight crew "You have the runway in sight?". At 1900:51, the first officer stated, "Affirmative," and, at 1900:52, he transmitted to the controller, "Runway in sight."

Image courtesy of NTSB

According to the controller, less than one minute later, she observed the aircraft emerging from a snow shower at a low altitude and not aligned with the runway. Radar data shows that, at about this time, the aircraft started manoeuvring to the runway, entering a steep left turn for final runway alignment. While conducting this turn, the aircraft impacted terrain to the right of the extended runway centreline, 100 feet above the Runway 15 threshold elevation and 2,400 feet short of Runway 15.

The approach end of Runway 15 is at an elevation of 7,674 feet above mean sea level (AMSL), and the opposite end of the runway is at an elevation of 7,815 feet AMSL, resulting in an upward slope.

Flight crew coordination issues

The Avjet Operations Manual in effect at the time of the accident was dated July 15, 2000. Page 4-4 of the manual indicated that during descent, the captain was responsible for conducting an approach briefing after leaving 18,000 feet but before reaching 10,000 feet. The manual instructed the captain to emphasise the following:

- configuration
- approach speed
- final approach fix altitude

- minimum descent altitude
- visual descent point
- circling manoeuvre
- missed approach heading
- altitude, and intentions
- runway information
- abnormal conditions.

Although the CVR recorded the captain briefing a visual approach, the CVR did not record the captain briefing the instrument approach procedure or any of the instrument approach briefing information required by Avjet. Pages 4-4 and 4-5 of Avjet's Operations Manual indicate the flight crew call-outs that are required during the final approach segment of an instrument approach. The captain is responsible for announcing his intentions after the decision height or missed approach point (MAP). The first officer is responsible for several call-outs, including the following:

- At 1000 feet above minimums: Call "1000 to go, no flags."
- At 500 feet above minimums: Call "500 to go."
- At 100 feet above minimums: Call "Approaching minimums."
- At MDA (Non-precision): Call "At minimums (time) (distance) to go."
- At MAP (Non-precision): Call "Missed approach point, runway in sight" or "Missed approach point, runway not in sight."

Therefore, when the aircraft reached altitudes of 11,200, 10,700, and 10,300 feet, Avjet's Operations Manual required the first officer to call out, "1000 to go [until landing minimums]," "500 to go," and "approaching minimums," respectively. However, the CVR did not record him making any of these call-outs.

Image courtesy of Safetywise

According to an aircraft performance study conducted by the Safety Board, at 1900:39, the aircraft levelled off at an altitude of 10,100 feet - 300 feet below the minimum specified altitude required for the aircraft's position at the time. Further, as noted previously, at 1900:46 (about the time the captain was asking the first officer if he had the highway in sight), the aircraft had descended about 200 feet below the MDA, and, at 1900:52 (about the time the first officer responded to the Aspen tower controller that he had the runway in sight), it had descended about 450 feet below the MDA.

The first officer should have called out these deviations to the captain, but the CVR did not record him making these call-outs or challenging the captain about operation of the aircraft below the MDA, and radar data indicated the captain did not correct the descent. At 1901:21, when the aircraft was about 900 feet above the airport elevation, the CVR recorded a configuration deviation warning that lasted for 9 seconds. This warning indicated that the captain had deployed the spoilers after the landing gear had been extended and landing flaps selected in the full-down position (39°), which was prohibited by the regulator approved aircraft flight manual (AFM).

Further, when the captain deployed the spoilers, the engine power was set to about 55 per cent N2. The AFM states that the minimum engine power setting on final approach should be 64 per cent N2. CVR evidence indicated that the captain did not include the first officer in his decision-making process regarding spoiler deployment and power setting and that the first officer did not question or challenge the captain about either item.

At 1901:36, the aircraft passed the MAP about 485 feet above field elevation rather than the specified 2,385 feet. The first officer was required to call out, "Missed approach point, runway in sight," or "Missed approach point, runway not in sight," and the captain was required to announce his intentions. However, the CVR did not record either of these call-outs or any evidence that the captain or the first officer understood that they were flying at too low an altitude.

At about the same time as the aircraft passed the MAP, the captain asked, "Where's it at?" This statement suggests that the captain had not identified, or had lost visual contact with, the runway. At this point, the captain should have abandoned the approach or the first officer should have called for a go-around, especially because the aircraft was close to the ground in mountainous terrain. The first officer stated, "To the right," about six seconds after the captain's query. Even if the first officer did in fact have the runway in sight at this point, the captain, as the flying pilot, should not have been relying on the first officer for directional guidance during the visual transition from the instrument approach to the landing.

Conversations recorded by the CVR during the last two minutes of flight suggest that the flight crew was preoccupied with looking outside the cockpit in an attempt to visually locate the airport. As a result, the captain continued flight below the authorised MDA after failing to establish or maintain visual contact with the runway. The first officer did not challenge the captain's actions.

EXERCISE 17: WESTWIND ACCIDENT

Consider the following accident scenario and then discuss the flight crew co-ordination issues and in particular the role of crew resource management on decisions that were made.

The crew was conducting a practice locator/NDB approach to Alice Springs, at night, in clear moonless conditions. The approach involved a stepped descent in three stages using three navigation aids. The pilot in command had earlier briefed the co-pilot that the 'not below' altitude after the final approach fix for the approach (2,780 feet) would be used as 'the minimum' for their purposes.

The flight proceeded normally until the aircraft passed overhead the final approach fix when the pilot in command asked the co-pilot to set the 'minima' in the altitude alert selector. The co-pilot responded by calling and setting '2300 feet'. This altitude was the Category A/B aircraft minimum descent altitude as depicted on the Jeppesen chart for the approach.

The minimum descent altitude for the Westwind, which is a category C aircraft, was 3,100 feet. The 2,300 feet called by the co-pilot was acknowledged by the pilot-in-command, and the aircraft then descended to that altitude. Shortly after levelling at about 2,250 feet, the aircraft struck the top of the Ilparpa Range and was destroyed.

The crew had descended to the incorrect minimum descent altitude before reaching the appropriate sector of the approach. The investigation revealed a number of factors relating to the performance of the crew.

Image courtesy of Safetywise

Crew coordination

There was evidence of difficulties in the relationship between the two pilots before the flight, at least from the co-pilot's perspective. Reports indicate the co-pilot raised the issue with the captain in Darwin before departure, although the outcome of this meeting was not established.

However, the cockpit voice recording revealed that the difficulties between the crew continued during the accident flight. The recording indicated that these difficulties affected the co-pilot's willingness to communicate with the pilot in command. There were also indications that his task performance was affected and that he was reluctant to query the instructions or the performance of the pilot in command. For example, there were no questions from the co-pilot concerning the approach briefing, even though a number of significant items were omitted.

Also, he did not comment on the performance of the pilot in command during the approach, even though tracking and descent rate limits had been exceeded.

The investigation concluded that in such a cockpit environment, the ability of the two pilots to operate as an effective team was reduced.

EXERCISE 18: 'AIRTIME' DISCUSSION

- How is the relationship between Robert and John (Metro captain) and what impact does this have on the flight? How would you rate the effectiveness of their teamwork?
- How do you resolve conflict when you clash with another crew member? Is management quick to resolve interpersonal relationships' (conflict between two crew members) when there is a known problem?
- Robert, John and Barry (chief pilot) are having a post flight discussion. Use the following discussion points as a guide:
  - How would you describe John's leadership style on the flight?
  - How could Robert have 'managed upwards' on the flight?
  - If you were writing an article for *Flight Safety Australia* about the lessons to be learned from this flight, what would they be?

Now that you have discussed some of the issues from 'Airtime', make a list of any strategies you presently use (or could use) for improving the effectiveness of teamwork either as a single pilot or as a multi-crew member.

Table 15 Your teamwork strategies

Strategies to improve the effectiveness of teamwork

Now that you have identified your own strategies, let's find out what the experts think. Play the DVD and select 'Strategies page 1' then 'Teamwork'. Continue to make further notes in the above table. Discuss with a mentor or peer.

You have now completed the Teamwork module. When you are ready, please read Chapter 7 of the *Resource Guide* (page 106)

Notes:

Chapter 7 Leadership

This section provides some practical activities and exercises about leadership in the aviation environment.

Make sure you have read the section on ‘leadership’ in your *Resource Guide*.

EXERCISE 19: THE GIMLI GLIDER

On July 23, 1983, a Boeing 767 aircraft en route to Edmonton from Ottawa ran out of fuel over Red Lake, Ontario, about halfway to its destination. Contributing factors included a combination of inoperative fuel gauges, fuel loading errors and mistaken assumptions on the part of the flight crew. These errors and system failures were dealt with at length in the 104-page report of the Board of Inquiry (Lockwood, 1985). Only three paragraphs were devoted to the most extraordinary feature of this event: the forced landing at Gimli, a disused military airstrip, from which all 61 passengers and eight flight crew walked away unharmed and the aircraft was fit for service after relatively minor repairs.

When the second engine stopped, the aircraft was at 35,000 feet and 65 miles from Winnipeg. All the electronic gauges in the cockpit had ceased to function, leaving only stand-by instruments operative. The first officer, an ex-military pilot, recalled that he had flown training aircraft in and out of Gimli, some 45 miles away. When it became evident that they would not make it to Winnipeg, the captain, in consultation with air traffic control, redirected the aircraft to Gimli, now 12 miles away on the shores of Lake Winnipeg. The report continues as follows:

Fortunately for all concerned, one of Captain Pearson's skills is gliding. He proved his skill as a glider pilot by using gliding techniques to fly the large aircraft to a safe landing. Without power, the aircraft had no flaps or slats to control the rate and speed of descent. There was only one chance of landing. By the time the aircraft reached the beginning of the runway, it had to be flying low enough and slowly enough to land within the length of the 7,200 foot runway. As they approached Gimli, Captain Pearson and First Officer Quintal discussed the possibility of executing a side-slip to lose height and speed close to the beginning of the runway. This the captain did on the final approach and touched down within 800 feet of the threshold. (p. 29)

According to Reason (2003) the last laconic sentence in the report is a masterpiece of understatement. It is unlikely that either Boeing or Captain Pearson's employers had ever imagined the side-slip manoeuvre being applied to a wide-bodied jet airliner. As it turned out, however, it was almost certainly the only way that the aircraft could have made a safe landing under those circumstances. This was heroic improvisation at its most inspired and an example of exceptional leadership under high stress.

Discussion:

How would you describe the leadership displayed by Captain Pearson in the above incident?

Do you know of any good leaders? If so, what are the attributes that make them good at leading and motivating people?

EXERCISE 20: MANAGING UPWARDS

The Managing Upwards strategy is a tool taught to new hire pilots at Qantas Airways early in their career and reinforced through CRM training. The Qantas method is a 4 step process that is graduated by increasing urgency. It is explained in more detail below.

The subordinate crew member should:

1. Express personal concern ('I' messages). Examples:

- "I'm concerned we read back the clearance incorrectly".
- "I don't think that descent clearance was for us".
- "I'm worried we no longer meet the fuel requirements as we've lost so much time and fuel".

2. Define preferred options or alternatives.

Examples:

- "We could always divert to Darwin or even Port Moresby".
- "Why don't we ask ATC to repeat the clearance?"
- "If we come back to long range cruise we may be able to save enough fuel to prevent a diversion".

3. Ask for evaluation.

Examples:

- "Could you explain how the fuel for the diversion was calculated"?

4. Emergency language: This involves uttering a key trigger phrase.

Examples:

- "You must listen - we are approaching the wrong runway".
- "You must listen, captain - I don't think you're fit to fly."

The emergency language stage should only be used as a last resort. The words "You must listen" are the trigger words. The senior crew member to whom those words are addressed must stop their present train of thought. All crew members present must seriously consider the words being spoken and recognise that in the mind of the speaker an emergency situation has arisen. If the trigger words are spoken it is a mandatory reportable event to the safety department.

Discussion:

Think of a situation where you may have experienced some conflict with another person. Use the managing upwards strategy to design a graduate response to the situation.

EXERCISE 21: DAMNED IF YOU DO, DAMNED IF YOU DON'T

In some cases, junior crew members are faced with situations where a decision may have to be made about whether to inform the captain about an anomaly or not. Consider the following situation as described by a senior airline captain and recounted in Dekker (2007):

"It was my turn to go rest," he said, "and, as I always do, I told the first and second officer 'if anything happens, I want to know about it. Don't act on your own, don't try to be a hero. Just freeze the situation and call me. Even if it's in the middle of my break, and I'm asleep, call me. Most likely I will tell you it's nothing, and I'll go right back to sleep. I may even forget you have called. But call me'.

When I came back from my break, it turned out that a mechanical problem had developed. The first officer, in my seat, was quite comfortable that he had handled the situation well. I was irate. Why hadn't he called me? How can I trust him next time? I am ultimately responsible, so I have to know what's going on." (page 61)

Discussion question

Consider the above scenario from both the perspectives of the captain and the subordinate crew members.

During his break, the captain left two more junior crewmembers, with no formal responsibility, in charge of managing a developing problem.

Question: Do you agree with his reaction? If so why, or if not, why not?

The F/O may have thought interrupting the captain during his rest break for a superfluous problem that he had under control, was foolish. He risks the captain becoming cranky.

Question: As the first officer would you have done anything differently? Is the safe option always to call despite the pressures not to?

EXERCISE 22: 'AIRTIME' DISCUSSION

Consider the captain of the Metro — how he could have been a better leader?

Now that you have discussed some of the issues from 'Airtime', make a list of any strategies you presently use (or could use) for improving the effectiveness of your leadership, either as a single pilot or as a multi-crew member:

Table 16 Your leadership strategies

Strategies to improve leadership

Now that you have identified your own strategies, let's find out what the experts think. Play the DVD and select 'Strategies page 2' then 'Leadership'. Continue to make further notes in the above table. Discuss with a mentor or peer.

You have now completed the Leadership module. When you are ready, please read Chapter 8 of the *Resource Guide* (page 124)

Notes:

Chapter 8

Situational awareness

This section provides some practical activities and exercises about situational awareness in the aviation environment.

Make sure you have read the section on 'situational awareness' in your *Resource Guide.*

EXERCISE 23: CONTRIBUTING FACTORS

Situational awareness (SA) is a critical mechanism for pilots in the performance of their role. Investigators have found generally, that incidents and accidents are underpinned by a loss of SA as a contributing factor. The accepted model for the study of SA in aviation is a model developed by Dr Mica Endsley. Endsley and accident investigators around the world have found that a failure of SA can occur at three different levels (aligning with the three levels in Endsley's model).

The three levels of SA according to Endsley are:

- Perception (noticing stimuli or inputs around us)
- Comprehension (understanding these)
- Projection (projecting ahead to plan and predict)

Research has indicated the likely levels at which your SA can fail (failing to perceive, failing to comprehend or failing to project ahead). In the small exercise below, indicate the level of SA that you consider might fail the most and lead to an incident or accident.

When considering the three levels of SA, what do you believe contributes to individuals (or teams) losing the bigger picture in your workplace? Break into a percentage totalling 100.

Table 17 Percentage of contribution towards loss of situational awareness

Percentage	Contribution
	Perception?
	Understanding?
	Projection?

Endsley 1994 Answers page 109

EXERCISE 24: DEADLY DISTRACTION

De Havilland DHC-8, ZK-NEY, Controlled Flight Into Terrain, Near Palmerston North, 9 June 1995

At 0817 on Friday 9 June 1995 ZK-NEY, a de Havilland DHC-8 (Dash 8) aircraft, departed Auckland as scheduled Ansett New Zealand Flight 703 bound for Palmerston North. Aboard were a crew of three and 18 passengers.

To the north of Palmerston North the pilots briefed themselves for a VOR/DME approach to runway 07 which was the approach they preferred. Subsequently air traffic control specified the VOR/DME approach for runway 25, due to departing traffic, and the pilots re-briefed for that instrument approach without further incident. The approach involved flying in and out of stratiform cloud, but continuous cloud prevailed during most of the approach.

The aircraft was flown accurately to join the 14 nm DME arc and then turned right and intercepted the final approach track of 250° M to the Palmerston North VOR. During the right turn, to intercept the inbound approach track, the aircraft's power levers were retarded to FLIGHT IDLE and shortly afterwards the first officer advised the captain ".... 12 DME looking for 4000 (feet)". The final approach track was intercepted at approximately 13 DME and 4700 feet, and the first officer advised Ohakea Control "Ansett 703" was "established inbound".

Just prior to 12 miles DME the captain called “Gear down”. The first officer asked him to repeat what he had said and then responded “OK selected and on profile, ten - sorry hang on 10 DME we’re looking for four thousand aren’t we so - a fraction low”. The captain responded, “Check, and Flap 15”. This was not acknowledged but the first officer said, “Actually no, we’re not, ten DME we’re..... (The captain whistled at this point) look at that”.

The captain said, “I don’t want that.” and the first officer responded, “No, that’s not good is it, so she’s not locked, so Alternate Landing Gear...?” The captain acknowledged, “Alternate extension, you want to grab the QRH?” After the first officer’s “Yes”, the captain continued, “You want to whip through that one, see if we can get it out of the way before it’s too late.”

The captain then stated, “I’ll keep an eye on the aeroplane while you’re doing that.” The first officer located the appropriate “Landing Gear Malfunction Alternate Gear Extension” checklist in Ansett New Zealand’s Quick Reference Handbook (QRH) and began reading it. He started with the first check on the list but the captain told him to skip through some checks. The first officer responded to this instruction and resumed reading and carrying out the necessary actions. It was the operator’s policy that all items on the QRH checklists be actioned, or proceeded through, as directed by the captain.

The first officer carried out the checklist correctly up to and including the item: L/G ALTERNATE RELEASE DOOR - OPEN FULLY & LEAVE OPEN to which he commented “which it is.” However he then continued “and insert this handle and operate until main gear locks, actually nose gear.”

The correct sequence was: L/G ALTERNATE RELEASE DOOR OPEN FULLY & LEAVE OPEN. MAIN GEAR RELEASE HANDLE PULL FULLY DOWN. L/G ALTERNATE EXTENSION DOOR OPEN FULLY & LEAVE OPEN. Insert pump handle and operate until main landing gear locks down.

The captain noticed the first officer’s actions and advised “You’re supposed to pull the handle ...”. The first officer then pulled the main gear release handle and had just finished saying, “Yeah that’s pulled here we go”, when the GPWS’s audio alarm sounded.

Between four and a half and four point eight seconds later the aircraft collided with the terrain. One crew member and two passengers were killed during the impact sequence. Another passenger died 12 days later from burns received after he had escaped from the aircraft’s cabin.

Image courtesy of Safetywise

According to the accident report findings, the flight crew's poor decision making was a significant contributing factor, specifically:

- The captain's lack of attention to, and/or misperception of, the aircraft's altitude during the approach.
- The pilot's diversion from the primary task of flying the aircraft and ensuring its safety, by their endeavours to correct an undercarriage malfunction.
- The captain's perseverance with his decision to attempt to get the undercarriage lowered without discontinuing the instrument approach in which he was engaged when the situation arose.

This accident above with ZK-NEY highlights the need for pilots to monitor the position of their aircraft in relation to the ground and other traffic, regardless of any system problem. It also suggests that distractions are the main cause of loss of situational awareness. Because problems in the air are not always neatly labelled, and may have begun well before the aircraft took off, it is easy for pilots to get distracted with minor problems at the cost of maintaining situation awareness.

When a malfunction occurs, it should trigger a 'red flag' for a heightened sensitivity to a potential loss of situational awareness.

A model of situational awareness

The accident described above involving ZK-NEY can be used to illustrate the concept of Endsley's (1988) model of SA. According to the model:

The environment that the ZK-NEY crew were operating in was high in workload given the approach and landing stage of flight and inclement weather.

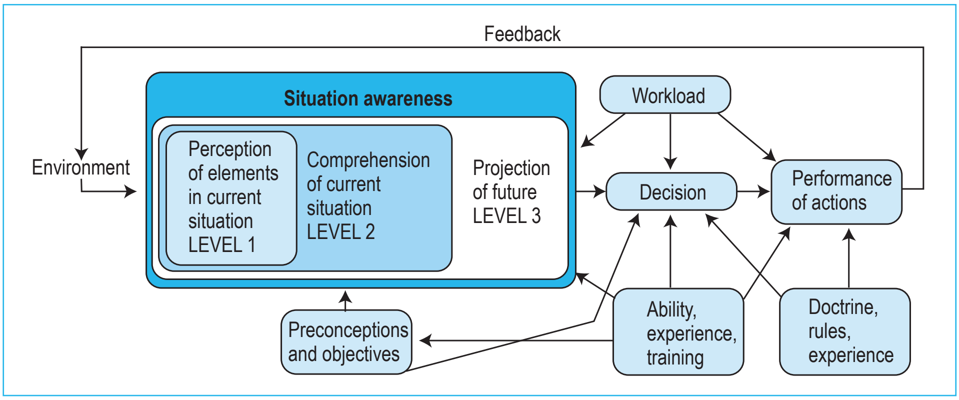
The crew's situational awareness involved three levels:

- Level 1 perception of elements. The gear warning light was a cue that indicated a problem with their landing gear.
- Level 2, comprehending what those elements mean. The crew quickly identified that the gear warning light indicated a serious problem, resulting in the alternate gear extension checklist having to be consulted
- Level 3, using that understanding to project future states. The crew understood that the gear malfunction situation had a number of implications such as; the problem is time critical, that the checklist needs to be followed, the cabin crew and passengers may need to be briefed and that aircraft flying and navigation should be maintained.
- Information that is gathered as part of situational awareness, typically results in a decision. The decision in the case of ZK-NEY involved the captain flying the aircraft and the F/O consulting the alternate gear extension checklist.
- Once a decision has been made the pilot(s) then search for cues (further feedback) to confirm the actions taken were appropriate. The cycle recommences, searching the environment for cues to update SA. In this case the captain interrupted the F/O as he was going through the alternate gear extension checklist which resulted in degraded SA.
- In Endsley's model a number of factors will influence the maintenance of SA and impact the quality of decision making. This may include:
    - Preconceptions and objectives, eg, has the crew encountered a similar problem before and how was it handled?
    - Ability, experience and training, eg, have the crew been trained in the use of the alternate gear extension procedure before and/or practised it in the simulator? When did they last have training in

CRM and in particular managing workload?

- Workload, eg, what is the level of workload at the time the problem of the landing gear is encountered?
- Doctrine, rules and procedures, eg, what are the SOPs to be used in the situation and what do crews generally do (culture)?

Figure 3 Endsley (1995) model of situational awareness.



A checklist

The following are common events identified in accidents that have involved a loss of situational awareness. If you answer yes to more than four items on the checklist, you could be losing situational awareness.

Table 18 Your situational awareness checklist

Area	Question	Answer
Ambiguous information	Do you have information from two or more sources that do not agree?	
Confusion	Are you uncertain or uneasy about a situation?	
Primary duties	Are all crew focused on non-flying duties?	
See and avoid	Is there too much heads-down time with nobody looking outside for conflicting traffic?	
Compliance	Is there non-compliance with aircraft performance limitations, minima etc?	
Standard operating procedures (SOP)	Are established SOPs not being followed by everyone?	
Fixation	Are you focused on any one task to the exclusion of others?	
Communication	Have you heard or made any vague or incomplete statements?	
Contradictions	Have you failed to resolve any discrepencies or contradictory information?	
Navigation	Have you failed to meet an expected checkpoint on the flight plan?	

Reference: www.crm-devel.org/resources/article/CASA%20sit_awre.pdf

10 tips for good situational awareness management

1. Predetermine crew roles for high-workload phases of flight.
2. Develop a plan and assign responsibilities for handling problems and distractions.
3. Solicit input from all crew members including cabin, ATC, maintenance, dispatch, etc.
4. Rotate attention from plane to path to people - don't fixate.
5. Monitor and evaluate current status relative to your plan.
6. Project ahead and consider contingencies.
7. Focus on the details and scan the big picture.
8. Create visual and/or aural reminders of interrupted tasks.
9. Watch for clues of degraded SA.
10. Speak up when you see SA breaking down.

Source: Vince Mancuso, Pete Wolfe and SA Tiger Team http://www.crm-devel.org/resources/article/flyingcareers.htm

EXERCISE 25: 'AIRTIME' DISCUSSION

Scenario 5

Wilko's (Chieftain pilot) rough ride (START: 20:06 – END: 25:30)

Wilko is preparing for his next flight and encounters some pressure from the passengers to get airborne quickly. En-route the flight encounters severe turbulence and the passengers become airsick. Use the following discussion points as a guide:

- How would you describe Wilko's situational awareness?
- How could he have managed the situation more effectively?

Now that you have discussed some of the issues from 'Airtime', make a list of any strategies you presently use (or could use) for improving the effectiveness of your situational awareness:

Table 19 Your situational awaareness strategies

Strategies to improve situational awareness

Now that you have identified your own strategies, let's find out what the experts think. Play the DVD and select 'Strategies page 2' then 'Situational awareness'. Continue to make further notes in the above table. Discuss with a mentor or peer.

You have now completed the situational awareness module. When you are ready, please read Chapter 9 of the *Resource Guide* (page 136)

Notes:

Chapter 9

Decision making

This section provides some practical activities and exercises about the need for effective decision making in aviation.

Make sure you have read the section on 'decision making' in your *Resource Guide*.

EXERCISE 26: THE MT HOTHAM ACCIDENT

On 8 July 2005, the pilot was conducting a charter flight, with two passengers on board, in a Piper PA31-350 Navajo Chieftain. The flight was initially planned to proceed from Essendon Airport to Mount Hotham, Victoria. However, because of adverse weather, the pilot revised his destination to Wangaratta. While en route, he diverted the aircraft to his originally intended destination, Mount Hotham. The pilot subsequently reported to air traffic control that he was overhead Mount Hotham. He changed the flight category from visual flight rules to instrument flight rules and advised his intention to conduct an instrument approach to runway 29. At about 1725, the pilot told the Mount Hotham airport manager by radio that he was on final approach for runway 29 and asked him to switch on the runway lights. After doing so, the manager attempted to tell the pilot that the lights had been switched on, but received no response. Subsequent attempts by air traffic control and the crews of other aircraft to contact the pilot were also unsuccessful. Because of hazardous weather conditions over the following two days, the search for the aircraft was primarily conducted on foot and horseback. The aircraft was located on a tree covered ridge, partially covered by snow. It had flown into trees in a level attitude, slightly banked to the right. Initial impact with the ridge was at about 200 ft below the elevation of the Mount Hotham aerodrome. The Chieftain had broken into several large sections and an intense fire had consumed most of the cabin. The occupants were fatally injured. The investigation determined that the aircraft systems had been operating normally. The weather conditions were ideal for a ‘flat light’ phenomenon that was likely to have denied the pilot adequate visual reference. The pilot may have experienced disorientation and loss of situational awareness. The aircraft was not equipped for flight in icing conditions, nor had the pilot complied with the requirements for flight under the instrument flight rules or in accord with the visual flight rules.

Consider the decisions made by the pilot about situations that confronted him during the flight:

- He decided to change his destination to Wangaratta (from Hotham) due to adverse weather.
- Enroute, a further decision was made to divert to the original destination of Mt Hotham despite no improvement in weather conditions.
- A change of flight category from the VFR to the IFR was decided. Despite this, the accident investigation by ATSB determined that the pilot did not conform to the requirements for conducting flight under the IFR or the VFR.

Did the pilot realise the consequences of his decision making and what pressure or influences was the pilot under that might have been involved in his decision making? Can you identify any of the hazardous attitudes that could influence the decision making process? Specifically, you can read about the operational decision making process in the full report of the ATSB investigation in the analysis section at paragraph 2.3. Further reading on this accident can be found at the following link: www.atsb.gov.au/publications/investigation_reports/2005/AAIR/aair200503265.aspx

EXERCISE 27: DECISION MAKING

Consider the following scenarios which ask you to provide a response which most accurately reflects the reasoning behind the hypothetical decision situation presented. Rank the five given reasons for the pilot making the decision, even though you may not consider any of the five choices acceptable or would have made that decision yourself.

Instructions

- Read over each of the six situations and the five choices. Keep in mind that there are no correct answers.
- Decide which one of the five choices is the most likely reason for the decision made. Place the number 5 in the space provided.
- Continue by ranking in declining order the remaining four probable reasons from 4 (next most likely) to 3, 2, and 1 (least likely) until all five blanks have been filled. The figure below provides an example of how the alternatives might be ranked.
- After you've finished discuss your answers in small groups.

Situation 1

A pilot is on a flight to an unfamiliar, rural airport. Flight Service states that VFR flight is not recommended since heavy coastal fog is forecast to move into the destination airport area about the time he is expected to land. He first considers returning to his home base where visibility is still good, but decides instead to continue as planned and land safely after some problems. Why did he reach this decision?

Table 20 Situation 1—reason for decision

Reason for decision	Rank
He hates to admit that he cannot complete his original flight plan.	
He resents the suggestion by flight service that he should change his mind.	
He feels sure that things will turn out safely, and that there is no danger.	
He reasons that since his actions would make no real difference, he might as well continue.	
He feels the need to decide quickly, so he takes the simplest alternative.	

Situation 2

While taxiing for takeoff, a pilot notices that her right brake pedal is softer than the left. Once airborne, she is sufficiently concerned about the problem to radio for information. Since strong winds are reported at the destination, an experienced pilot who is a passenger recommends that she abandon the flight and return to her departure airport. She instead chooses to continue the flight and experiences no further difficulties. Why did she continue?

Table 21 Situation 2—reason for decision

Reason for decision	Rank
She felt that suggestions made in this type of situation are usually overly cautious.	
Her brakes have never failed before, so she doubts they will this time.	
She feels that she can leave the decision to the tower at her destination.	
She immediately decides that she wants to continue.	
She is sure that if anyone could handle the landing, she can.	

Situation 3

A pilot's regular aircraft has been grounded because of an airframe problem. He is scheduled in another aircraft and discovers it is a model he is not familiar with. After the pre-flight, he decides to take off on his business trip as planned. What was his reasoning behind this decision?

Table 22 Situation 3—reason for decision

Reason for decision	Rank
He feels that a difficult situation will not arise so there is no reason not to go.	
He tells himself that if there were any danger, he would not have been offered the aircraft.	
He is in a hurry and does not want to take the time to think of alternate choices.	
He does not want to admit that he may have trouble flying an unfamiliar aircraft.	
He is convinced that his flight instructor was much too conservative and pessimistic when he cautioned him to be thoroughly checked out in an unfamiliar aircraft.	

Situation 4

A pilot was briefed about possible icing conditions, but did not think there would be any problem since his departure airport temperature was 60 degrees F (15 degrees C). As he nears his destination, he encounters freezing precipitation, which clings to his aircraft. His passenger, who is a more experienced pilot, begins to panic. He considers turning back to the departure airport, but continues instead. Why did he not return?

Table 23 Situation 4—reason for decision

Reason for decision	Rank
The pilot has made it this far. He is thinking, "what is the use in turning back now?"	
The panic of the passenger makes him think, "it will not happen to me - I have encountered ice before and nothing has ever happened."	
The pilot is thinking, "why is he panicking? I can handle this situation just like I have done before."	
CASA regulations exaggerate the dangers of icing. He can handle this situation.	
He has got to do something. Descend! That will make everyone realise that he is in control.	

Situation 5

A pilot does not bother to check weather conditions at her destination. En route, she encounters headwinds. Her fuel supply is adequate to reach her destination, but there is almost no reserve for emergencies. She continues the flight and lands with a nearly dry tank. What most influenced her to do this?

Table 24 Situation 5—reason for decision

Reason for decision	Rank
Being unhappy with the pressure of having to choose what to do, she made a snap decision.	
She did not want her friends to hear that she had to turn back.	
She felt that flight manuals always understated the safety margin in fuel tank capacity.	
She believes that all things usually turn out well, and this will be no exception.	
She reasoned that the situation had already been determined because the destination was closer than any other airport.	

Situation 6

A pilot is 40 minutes late for a trip in a small aircraft. Since the aircraft handled well on the previous day's flight, he decides to skip most of the pre-flight check. What leads him to this decision?

Table 25 Situation 6—reason for decision

Reason for decision	Rank
He simply took the first approach that came to mind for making up time.	
He felt that his reputation for being on time demanded that he cut corners when necessary.	
He believed that some of the pre-flight inspection was just a waste of time.	
He saw no reason to think that anything unfortunate would happen during this flight.	
If any problems developed, the responsibility would not be his. It is the maintenance of the aircraft that really makes the difference.	

Tips to improve decision-making

The following tips are good practice to follow to improve the quality of decision-making, mitigate the possibility of errors in decision-making and ensure that a more considered approach is taken in resolving issues or problems.

- A good decision cannot be improvised, it must be prepared. The final decision will be better and taken more quickly, if all options have been considered in advance. Hence, the importance of good briefing practices and appropriate prior planning.
- Use decision-making aids. In other words, use operational checklists to ensure that you have not forgotten any important steps.
- Always keep capacity in reserve to react to unexpected events.
- Delegate your workload to other team members when time is critical.
- Keep the "big picture" rather than focusing on one aspect of a problem.

- Where possible, advise other co-workers of your intent before acting. This increases the chances of your decision being acted upon correctly and ensures that people are not caught unaware.
- When time is not so critical, involve other team members or co-workers in decision-making. This ensures that everybody has a vested interest in the decision and may therefore be more motivated to support it.

Further considerations for decision making

The FAA flight risk assessment tool

The proactive identification of possible hazards and the use of risk management tools to mitigate risks as aspects of flight operations are important. The following tool will provide ways for air operators to determine which flights have more risk and allow operators to intervene and reduce risk when possible by early decision making underpinned by a reasonably robust and logical approach to the problems.

Use of the tool

Recommended action: The FAA recommends that operators and pilots familiarize themselves with the attached risk assessment tool and AC 120-92. They should then decide whether to use the tool as published or to modify it as needed for their own operations. Once an operator has established the parameters of the tool, it should create operational thresholds and begin using the tool to establish a "risk number" for each flight. This risk number should be used to control risk before a flight takes place. Over time this tool will become unique to each operator and can become a part of its complete SMS.

Note: The risk assessment tool cannot guarantee a safe flight. Safety is ultimately the responsibility of the pilot and operator. However, it does provide an additional tool to help the pilot and operator make sound decisions regarding safety.

Table 26 Flight risk assessment tool 1

Date:	Departure:		
Release/trip #:	Destination:		
Tail #: N123		**Risk Value**	**Flight Value**

Pilot Qualifications and Experience			
1	Captain with less than 200 hours in type	5	
2	First officer with less than 200 hours in type	5	
3	Single pilot flight	5	
4	Captain with less than 100 hours last 90 days	3	
5	First officer with less than 100 hours last 90 days	3	
6	Duty day greater than 12 hours	4	
7	Flight time (Greater than 8 hours in the duty day)	4	
8	Crew rest (Less than 10 hours prior to the duty day)	5	
	Total Factor Score – Section 1	**8(5)**	

Operating environment			
9	VOR/GPS/LOC/ADF (Best approach available w/o vertical guidance)	3	
10	Circling approach (best available approach)	4	
11	No published approaches	4	
12	Mountainous airport	5	
13	Control tower not operational at ETA or ETD	3	
14	Uncontrolled airport	5	
15	Alternate airport not selected	4	
16	Elevation of primary airport greater than 5000ft MSL	3	
17	Wet runway	3	
18	Contaminated runway	3	
19	Winter operation	3	
20	Twilight operation	2	
21	Night operation	5	
22	Stopping distance greater than 80 per cent of available runway	5	
23	Repositioning flight (no passengers or cargo)	5	
24	Pop up trip (less than 4 hours crew notice)	3	
25	International operation	2	
26	No weather reporting at destination	5	
27	Thunderstorms at departure and/or destination	4	
28	Severe turbulence	5	
29	Ceiling and visibility at destination less than 500ft/2sm	3	
30	Heavy rain at departure and/or destination	5	
31	Frozen precipitation at departure and/or destination	3	
32	Icing (moderate-severe)	5	
33	Surface winds greater than 30 knots	4	
34	Crosswinds greater than 15 knots	4	
35	Runway braking action less than good	5	
	Total factor score – section 2	**12(8)**	
Equipment			
36	Special Flight Permit Operation (ferry permit)	3	
37	MEL/CDL items (items related to safety of flight)	2	
38	Special flight limitations base don AFM equipment limitations	2	
39	Total factor score – section 3	0	
	TOTALS	**20(13)**	

The following discussion provides a practical example of the five step process used to assess risk as outlined in AC 120-92. The example involves the operation of a night flight where the destination airport is experiencing windy, rainy conditions. The captain has fewer than 200 hours in type and the first officer has flown less than 100 hours in the last 90 days. Company SOP require the chief pilot to evaluate flight risk factor values over 20 from the perspective of accepting the risk, rejecting the risk, or mitigating the risk. Further, company SOP prevent the operation of a flight if the risk value exceeds 25.

Step 1: Complete a system and task analysis

- The captain is not highly experienced with less than 200 hours in type.
- The first officer has less than 100 hours in the last 90 days.

Step 2: Identify the hazards

- The runway is wet.
- The flight will operate at night.
- The destination crosswinds are greater than 15 knots.

Step 3: Analyse the safety risk

The combination of the risk factors associated with this flight generates a risk value of 20 using the sample risk assessment tool.

Step 4: Assess the safety risk

Company policy requires that the chief pilot assess and approve any flight risk value greater than 15. Since the risk value of 20 exceeds the company operational threshold risk of 15, the chief pilot decides to operate the flight by reducing the flight risk value to a more acceptable level.

Step 5: Control the safety risk

The chief pilot focuses on mitigating three hazards:

1. He decides to allow the scheduled captain to operate the flight.
2. However, he assigns the flight to a first officer who is more current and who has flown more than 100 hours in the last 90 days.
3. Further, the chief pilot changes the destination airport to an airport with no crosswind expected.

In the example below the non-parenthetical numerical value represents the original risk value assigned to the hazard. Risk values in parenthesis represent the reduced risk values assigned after the chief pilot acted to mitigate the risks. By controlling the risk value of the three above hazards, the chief pilot has reduced the flight overall risk value to 13 and elevates the level of operational safety.

Table 27 Flight risk assessment tool 2

Date: any day	Departure: DAL		
Release/trip #: 153	Destination: PDK		
Tail #: N123		Risk Value	Flight Value

Pilot Qualifications and Experience			
1	Captain with less than 200 hours in type	5	5
2	First officer with less than 200 hours in type	5	
3	Single pilot flight	5	
4	Captain with less than 100 hours last 90 days	3	
5	First officer with less than 100 hours last 90 days	3	3 (0)
6	Duty day greater than 12 hours	4	
7	Flight time (Greater than 8 hours in the duty day)	4	
8	Crew rest (Less than 10 hours prior to the duty day)	5	
	Total Factor Score – Section 1	**8(5)**	
Operating environment			
9	VOR/GPS/LOC/ADF (Best approach available w/o vertical guidance)	3	
10	Circling approach (best available approach)	4	
11	No published approaches	4	
12	Mountainous airport	5	
13	Control tower not operational at ETA or ETD	3	
14	Uncontrolled airport	5	
15	Alternate airport not selected	4	
16	Elevation of primary airport greater than 5000ft MSL	3	
17	Wet runway	3	3
18	Contaminated runway	3	
19	Winter operation	3	
20	Twilight operation	2	
21	Night operation	5	5
22	Stopping distance greater than 80 per cent of available runway	5	
23	Repositioning flight (no passengers or cargo)	5	
24	Pop up trip (less than 4 hours crew notice)	3	
25	International operation	2	
26	No weather reporting at destination	5	
27	Thunderstorms at departure and/or destination	4	
28	Severe turbulence	5	
29	Ceiling and visibility at destination less than 500ft/2sm	3	
30	Heavy rain at departure and/or destination	5	

31	Frozen precipitation at departure and/or destination	3	
32	Icing (moderate-severe)	5	
33	Surface winds greater than 30 knots	4	
34	Crosswinds greater than 15 knots	4	4(0)
35	Runway braking action less than good	5	
	Total factor score – section 2	**12(8)**	
Equipment			
36	Special flight permit operation (ferry permit)	3	
37	MEL/CDL items (items related to safety of flight)	2	
38	Special flight limitations base don AFM equipment limitations	2	
39	Total factor score – section 3	0	
	TOTALS	**20(13)**	

EXERCISE 28: 'AIRTIME' DISCUSSION

Robert is suffering from a migraine and the effects of flu and poor sleep. He decides that he is OK to fly.

- What are the impacts of Robert's decision?
- At what stage did Robert have an opportunity to review his decision?
- What should he have done?

Now that you have discussed some of the issues from 'Airtime', make a list of any strategies you presently use (or could use) for improving the effectiveness of your decision making.

Table 28 Your decision making strategies

Strategies to improve decision making

Strategies to improve decision making

Now that you have identified your own strategies, let's find out what the experts think. Play the DVD and select 'Strategies page 2' then 'Decision making'. Continue to make further notes in the above table. Discuss with a mentor or peer.

You have now completed the Decision making module. When you are ready, please read Chapter 10 of the *Resource Guide* (page 146)

Notes:

Chapter 10

Threat and error management (TEM)

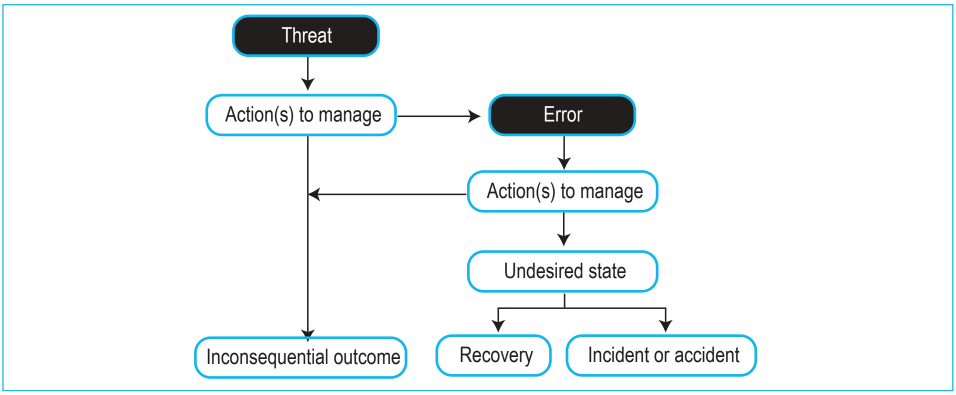
This section provides some practical activities and exercises on the subject of threat and error management.

Make sure you have read the section on ‘Threat and error management’ in your *Resource Guide.*

EXERCISE 29: MANAGING THREATS AND ERRORS

Operationally, the cycle of threats and errors and the way they are dealt with by aircrew (and other aviation professionals for that matter) occur in the following way:

Figure 4: Threat and error model



Consider operational events that you have experienced in line flying that fit into this model. What could you have done better to prevent threats and errors from developing into an undesired state from which, if you are to prevent a potentially major safety occurrence, must recover? Note also, that by the time of experiencing an undesired state you are already involved in an incident be it minor or serious.

EXERCISE 30: THREAT AND ERROR MANAGEMENT QUIZ

Discussion questions on threats

Studies that have examined how flight crews manage threats and errors in normal flight operations reveal some interesting facts about threat frequency and error prevalence. Merrit and Klinect (2006) provide some real world data, based on the Line Operation Safety Audit (LOSA) tool, a method that observes how flight crew manage a "normal" line flight.

Questions are provided throughout this section based on 4500 LOSA observations across 25 airlines. Answer each of the questions by circling your best guess, and compare your responses with the correct answers, provided at the end of this booklet.

Table 29: Threat and error management quiz

Question	Circle answer
1 On average, how many threats per flight (regularly scheduled, normal operations) are encountered by flight crews?	A) One threat every 2-3 flights B) One threat per flight C) 1-3 threats per flight D) 4-6 threats per flight
2 In what phase of flight do most threats occur?	A) Predeparture/Taxi-out B) Takeoff/Climb C) Cruise D) Descent/Approach/Land
3 What are the most frequently encountered threats by flight crews?	A) Adverse weather (e.g., thunderstorms) B) ATC (e.g., challenging clearances) C) Aircraft (e.g., malfunctions / anomalies) D) Airport (e.g., poor signage/construction)
4 What per cent of threats are successfully managed by flight crews? (i.e., percentage of threats not contributing to a flight crew error)	A) 95-100% B) 85-95% C) 75-85% D) Less than 75%
5 Of all threats encountered by flight crews in the LOSA Archive, which are the most problematic?	A) Adverse weather (e.g., thunderstorms) B) ATC (e.g., challenging clearances) C) Aircraft (e.g., malfunctions / anomalies) D) Airport (e.g., poor signage/construction)

Answers page 109

Discussion questions on errors

Test your knowledge of flight crew errors and their management by circling your best guess to the following questions.

Table 30: Flight crew error management quiz

Question	Circle answer
1 How often do flight crew errors occur on average on a typical flight?	A) Approximately 5% of flights have some form of observable crew error B) Approximately 50% of flights have some form of observable crew error C) Approximately 80% of flights have some form of observable crew error D) All LOSA flights (100%) have at least one observable crew error
2 In what phase of flight do most flight crew errors occur ? When do the mismanaged errors occur? (Hint: The answer is the same phase of flight for both questions)	A) Predeparture/taxi-out B) Takeoff/climb C) Descent/approach/Land D) Taxi-in/park

Question	Circle answer
3 What are the most frequently committed flight crew errors?	A) Aircraft handling (e.g., wrong automation setting) B) Procedural (e.g., omitted callout) C) Communication (e.g., incorrect ATC readback)
4 What are the most common procedural errors?	A) Briefing B) SOP cross-verification C) Callout D) Checklist
5 What percentage of errors are mismanaged by flight crews (i.e., percentage of errors linking to an additional error or undesired aircraft state)	A) 20-30% B) 30-40% C) 40-50% D) More than 50%
6 What are the most frequently mismanaged flight crew errors?	A) Manual handling/flight control B) Automation C) System/instrument/radio D) Checklist

Answers page 110

Discussion questions on undesired aircraft states

Test your knowledge of undesired aircraft states and their management by circling your best guess to the following questions. Correct answers with discussion are provided at the end of this section.

Table 31: Undesired aircraft states and their management quiz

Question	Circle answer
1 How common are undesired aircraft states (UAS)?	A) Less than 1% of flights have a UAS B) 15% of flights have a UAS C) 35% of flights have a UAS D) 50% of flights have a UAS
2 What are the most frequent UAS's observed?	A) Incorrect systems configurations (e.g., wrong anti-ice setting in icing conditions) B) Speed deviations C) Lateral and vertical deviations D) Incorrect automation configurations (e.g., wrong altitude dialled after cross-check)
3 How common are unstable approaches and how often do they result in a missed approach?	A) Less than 1% of flights have an unstable approach; of those, 95% result in a missed approach B) 5% of flights have an unstable approach; of those, 5% result in a missed approach C) More than 15% of flights have an unstable approach; of those, 50% result in a missed approach

4 How many UAS's can be linked back, via mismanaged crew error, to a mismanaged threat?	A) Virtually all UAS's come about because of a threat that was mismanaged (95-100%) B) About 70% of all UAS's are linked to a mismanaged threat; the rest emerge from "spontaneous" crew errors that were mismanaged ("spontaneous" = not linked to a threat) C) About 30% of all UAS's are linked to a mismanaged threat.

Answers page 110

EXERCISE 31: 'AIRTIME' DISCUSSION

Think about the Airtime drama and the threats and errors confronting the Metro crew (John and Robert) and Wilko's rough ride in the Piper Chieftain.

- Can you categorise the events in these two scenarios into threats and errors and determine what could have been done to avoid the undesired states?
- If an undesired state occurred, how did the crew recover?

Now that you have discussed some of the issues from 'Airtime', make a list of any strategies you presently use (or could use) for improving your own threat and error management process.

Table 32 Your threat and error strategies

Strategies to improve threat and error management

Now that you have identified your own strategies, let's find out what the experts think. Play the DVD and select 'Strategies page 2' then 'TEM'. Continue to make further notes in the above table. Discuss with a mentor or peer.

You have now completed the Threat and error management module. When you are ready, please read Chapter 11 of the *Resource Guide* (page 164)

Notes:

Chapter 11

Airmanship

This section provides some practical activities and exercises on the subject of airmanship.

Make sure you have read the section on ‘Airmanship’ in your *Resource Guide*

EXERCISE 32: YOUR DECISION

Consider the following scenario

You are at the local municipal airport to pick up three passengers and return to the regional airport. Before refuelling, you add up the weight and find that with full useable fuel (189 litres) your load will be 22 kilos over the allowable maximum gross weight. Weather for the 1500 hours return is forecast to be 2/8ths at 6000 feet, visibility >10kms temperature for take off is 370C, winds at the proposed cruise altitude should provide a 14 knot tailwind.

Using the flight manual's fuel consumption rate and adding in the tailwind, you determine you will burn 159 litres for the trip, landing with 30 litres or exactly 45 minutes of fixed reserve. You will over fly another regional airport en-route, however, if you land there for fuel, you will not get home until after dark and the VSI post light is U/S.

You decide to: (choose A, B, C or D)

- A: Take on 159 litres fuel and fly directly to your destination airport.
- B: Take on 189 litres and fly directly to your destination airport.
- C: Take on 159 litres, plan for a stop at the regional airport en-route for additional fuel.
- D: Ask one passenger to leave a 20 kilo bag and have it sent by ground transport. Take on 189 litres and fly directly to the regional airport.

Discussion questions

Q 1. What is the best choice, based on safety, for typical 500 hour NVFR private pilots?

Q 2. How likely is it that pilots will make this choice? (100% - all would make the choice, 0% - none would make this choice)

Q 3. If you feel less than 100% would make this choice what other choice might the pilot make?

Q 4. If the best choice (as you determine) is made, what is the level of risk for the pilot?

- # low
- # medium
- # high
- # very high risk

Q5. What are the risk factors? Why did you assess the risk level you chose?

Discussion question

Think of a pilot that you consider to have superior airmanship. Write down 5 things that you think defines their superior knowledge and skill (ie, their assertive communication style etc)

1.
2.
3.
4.
5.

Compare and contrast with your colleagues, whether the five things that you have identified are the same as their list? Is there a pattern of common traits?

EXERCISE 33: AIRMANSHIP IN PRACTICE

The above case studies illustrated both ineffective and effective airmanship. However, airmanship may mean different things to different pilots, so what is it really in practice? Consider whether you do any of the following in your current flying by ticking always, mostly or sometimes in the space provided?

Table 33 Airmanship in practice

Current flying practices	Always	Mostly	Sometimes
Do you consistently perform a proper pre-flight check of an aircraft and not just a casual look-around?			
Before turning an aircraft in flight or during taxiing do you instinctively look around before turning?			
Do you actually perform pre take-off and pre-landing checks – not just mouth the words?			
Do you do the same level of pre-flight planning for a circuit as you would for a cross country flight?			
Do you make every effort to interpret a changing weather pattern – rather than just accept the published information?			
Do you routinely think ahead and have a plan for when things might go wrong?			
Do you treat every landing as a go around, so that on the day you have to do one for real you execute it flawlessly?			

Count up the number of ticks:

- 7 ticks in 'always' = Outstanding airmanship
- 4 or fewer ticks in 'always' = Superior airmanship
- 2 or fewer ticks in 'always' = Basic airmanship

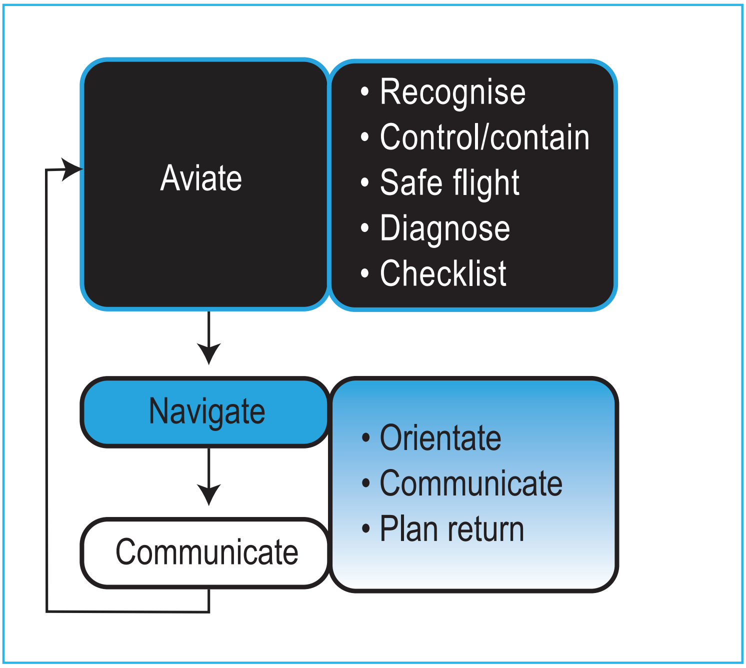
11 – Airmanship

EXERCISE 34: PRACTICE MAKES PERFECT

A final model for assisting with developing airmanship

The following model has been used within the Australian military flying training system as a guidance tool for supporting the development of improved preparation and sound habit patterns when faced with abnormal situations. The model as follows:

Figure 5 Military model to assist with developing airmanship



It follows the basic premise used within many training systems in that the priority is to 'Aviate- Navigate-Communicate'. There is no point having an extended discussion with ATC if it breaks down your normal aircraft scan and results in your aircraft entering an unusual attitude, particularly if you are already close to the ground. When you consider the nature of abnormal operations some require immediate actions to occur within minimal time to control/contain a situation. Depending on the outcome this will determine how much time you have left to diagnose the situation. Let's look at a practical example. Consider you are completing an endorsement on a twin engine aircraft (let's assume it's a Piper Seneca III) and you are preparing on the ground by considering what could go wrong and visualising what you would do if certain abnormal events occurred. In this scenario you have decided to mentally prepare for the scenario that you are on descent, under instrument conditions and approaching a non-directional beacon (NDB) to go overhead outbound for the approach. As you visualise your approach overhead the NDB you consider what you would do if flames were coming out of the left hand engine. Let's use the model to prepare for this scenario:

Table 34 Military airmanship model

	Checklist	Actions to consider	Information from the Piper Seneca Information Manual / other company documents
AVIATE	Recognise	■ How will I confirm I have an engine fire? ■ What would I expect to see, hear? ■ What if I'm not sure? ■ Is there a more experienced pilot (e.g. Chief Pilot) with extensive experience on this aircraft to help understand what I could expect?	■ The possibility of an engine fire is extremely remote. The procedure given below is general and pilot judgement should be the deciding factor for action in such an emergency.
	Control/ contain	■ If I have a confirmed fire I need to be able to carry out the checklist items to contain/control the fire as quickly as possible. This is an immediate priority and there may not be time to consult the checklist. ■ Do I know the checklist? ■ Have I practised the hand movements and visualised the patterns of checks to be comfortable this will be an automatic response? ■ This will be critical as there will be high levels of stress (possibly some panic) if this scenario occurs. ■ Do I have the time to complete the engine securing procedure on the affected engine or should I focus on safe flight?	■ Place the fuel selector of the affected engine to the OFF position and close its throttle. ■ Feather the prop on the affected engine. ■ Move the mixture control to idle cut-off. ■ Turn OFF the heater and defroster units. ■ The cowl flap should be open.
	Safe flight	■ If the fire is contained and I can maintain straight and level on a single engine it is time to achieve safe flight as a priority. ■ Get the aircraft into a known configuration, trimmed and at a level above lowest safe. If you have time and can maintain this configuration let someone know what's happening and ask for further support e.g. radar monitoring. This will ensure I maintain safe flight.	■ Configure the aircraft using: power + attitude = performance ■ As per company SOPs.

	Checklist	Actions to consider	Information from the Piper Seneca Information Manual / other company documents
AVIATE	Diagnose	■ In this case the outcome is clear and there is no requirement to diagnose further. In other circumstances, once the immediate abnormality has been contained and safe flight achieved, it could be an opportunity to do some further fault finding to clarify the abnormality. ■ This is an opportunity to use some of the previous decision making models e.g. GRADE to further assess and resolve any problems that may not been clearly defined. This often means there is not a clear checklist choice to cater for the problem until this has been resolved.	■ No further considerations.
	Checklist	■ Use the checklist to confirm the correct actions have been (or will be) conducted. ■ For time critical emergencies initial checklist actions may have to be performed from memory. ■ For non-time critical emergencies it may be better to ingrain habit patterns which ensure you read your checks from the checklist.	■ Pull out the checklist and confirm checks have been completed appropriately. The engine securing procedure checklist as follows: ■ Throttle RETARD TO VERIFY ■ Propeller FEATHER (800RPM Min) ■ Mixture IDLE CUT-OFF ■ Cowl flap CLOSE ■ Alternator OFF ■ Magnetos OFF ■ Fuel Selector OFF ■ Electrical load REDUCE ■ Crossfeed AS REQUIRED
NAVIGATE / COMMUNICATE	Orientate	■ Where am I? ■ How is my scan going? ■ Am I maintaining safe flight?	■ As per company SOPs.
	Communicate	■ I should be a bit more organised. Who do I need to talk to provide an update of the situation?	■ As per company SOPs and AIP.
	Plan	■ Where am I? ■ Where am I going? ■ How will I get there? ■ How much time do I have?	
	Normal cycle	AVIATE – NAVIGATE – COMMUNICATE	

While the preceding table may not contain all the information you consider is required, it serves as an example of how you can use a model to help you mentally prepare on the ground, particularly for those rare emergencies that may be time critical and highly stressful. You can be assured this technique is used regularly by professional and disciplined pilots. Think back to the comments and actions by the Red Bull pilots from the DVD in preparation for their race. You can see them visualising their sequence prior to flight to ensure they are mentally prepared. This same technique is a necessity with passing military flight training and maximising your ability to get the most out of any flying training system.

EXERCISE 35: 'AIRTIME' DISCUSSION

Think about the Airtime drama and the series of incidents that confront the Metro crew (John and Robert) and Wilko's rough ride in the Piper Chieftain.

- Describe the airmanship displayed by each crew member
- If you were the chief pilot of Rover Airlines and were providing advice to Wilko about improving his level of airmanship, what advice would you give?

Now that you have discussed some of the issues from 'Airtime', make a list of any strategies you presently use (or could use) for improving your own level of airmanship.

Table 35 Your airmanship strategies

Strategies to improve airmanship

Now that you have identified your own strategies, let's find out what the experts think. Play the DVD and select 'Strategies page 2' then 'Airmanship'. Continue to make further notes in the above table. Discuss with a mentor or peer.

You have now completed the Airmanship module. When you are ready,the final exercise is contained within this workbook. Please turn over and read Chapter 12.

Notes:

Chapter 12

Safety reporting

This section provides some practical activities and exercises on the subject of safety reporting.

INTRODUCTION

One of the keystones of safety within Australia's aviation industry and one of the major factors behind the outstanding aviation safety record that Australia possesses when compared to the rest of the world is the fact that safety concerns are readily reported. Australian aviation organisations are known to honestly and openly report what is going on with regards to safety within their organisations so that if errors do occur, the organisation and other areas within the industry can learn from these mistakes and actively take steps to ensure they do not occur again.

The main aim of safety reporting is to gather and disseminate safety intelligence. The sharing of safety intelligence throughout the industry ensures that better safety outcomes are achieved for all concerned. Safety reporting provides the aviation industry with data and information from which they can make decisions that will provide safe flying operations across the entire airspace. For example, if a number of operators are conducting similar navigation exercises in the same area, it may come to light, through appropriate safety reporting and trend analysis provided by the Australian Transport Safety Bureau (ATSB), that a corner of the airspace is being continually clipped. This may lead to Airservices Australia re-considering the design of that airspace or a problem coming to light with the conduct of that particular navigation exercise. Without honest and open safety reporting, the problem goes undiscovered and the root causes of the problem are not attended to until the errors lead to an accident.

For any flight crew, considering whether or not they should report an incident should raise alarm bells. If there is any such doubt, then it probably means the flight crew member should have reported the incident in the first place.

Safety Culture

A safety conscious organisation that presents as having a sound safety culture has good, fit-for-purpose equipment in good working order that has been designed using user-centred design principles. The safety conscious organisation is invariably a learning organisation: trains people well and keeps them up to date on all aspects of their knowledge requirements. They learn from lessons gained to improve the systems they have. This may encompass such things as changing a hazard report form to include a better way of reporting, or a more developed idea of capturing hazard information. A safety conscious organisation will attempt to improve the way things are done rather than just apportioning blame when things go wrong. These are the types of things a safety-minded and error-tolerant organisation will continually attempt to do.

Flight crews working in a safety conscious organisation need to remember their own responsibilities with regards to self-reporting incidents or errors that occur during their duty times. They also need to relay information (to chief pilots or general managers) that have the potential to lead to less than safe outcomes if not managed appropriately. For example, if a pilot has a second job with the potential to leave them fatigued then this information must be made available to an organisation's management so that they may manage, it effectively through proper rostering.

For the organisation's part, they must ensure that the policies they have relating to or having an impact on their safety practices (i.e. policies for things such as second jobs, fatigue or sterile cockpit) are clear and unambiguous and that the flight crew are well aware of them. The management of an organisation needs to ensure a good safety reporting culture by asking themselves if they are getting the right information from their flight crews and if they areseeing the right behaviours being displayed. If they portray a working environment where the reporting of safety concerns is seen as the right thing to do under any circumstances, without fear or favour, then they are on the right track to having a good safety culture.

In terms of leadership, a senior member of an organisation is responsible for providing a positive example for junior pilots to follow. If the senior pilot is being seen to adopt safety reporting behaviours and doing the necessary things conducive to promoting a good safety culture within their organisation, then it is highly probable that junior pilots will follow suit. An expectation is set up across all flight crew from senior pilots to junior members that certain modes of behaviour with regards to safety and its reporting will be followed. It becomes part of 'the way we do business around here'.

Safety Management

Flying operations inspectors (FOI) at CASA have stated that when they commence an audit of an operator it becomes quite apparent quite early if the organisation under investigation or audit has a safety reporting culture. If, during conversations with staff, the FOI uncovers breaches of identifiable legislation or particular safety incidents that flight crew were unwilling to report to the chief pilot or general manager for fear of reprisals, then this is fairly indicative that the company does not have a good safety reporting culture.

FOIs have a tool called an observation report which can highlight potential areas where breaches of legislation are likely to occur within an organisation or areas of safety risk. The FOIs can then make recommendations where safety can be improved. This is a form of safety management within itself. Small operators can hear of upcoming requirements such as safety management systems (SMS) or fatigue risk management systems (FRMS) and believe that, due to their small organisational size, that this is not for them. However, an SMS can be as simple as ensuring pilots report back all safety related information on a safety reporting form and an organisation's SMS can grow from there.

Many organisations view safety reporting as an opportunity for all flight crew and staff to learn about events with the potential to affect safe flying operations and require that all crew and staff report back any and all safety-related concerns. If pilots are reticent to report a safety-related event for any reason, organisations can put in place a confidential reporting system that allows the report to be de-identified prior to its release for circulation. The reporting of safety-related incidents is of paramount importance to flying operations. The issues can be discussed at the next pilots' meeting in order to ensure all flight crew are aware of the dangers of certain events, and aircraft can be checked out for airworthiness if the event has stressed an aircraft part (i.e. nose wheel in the mud – as seen on the Airtime DVD).

A very good way to look at safety reporting is that by reporting all safety concerns, you are helping both your fellow pilots and your organisation. You will be helping your colleagues by providing lessons to enhance their safety awareness, and you will be helping your organisation by allowing them to build additional defences or improve current defences against errors and accidents. The trick to safety reporting is 'never to stand still and think you've got this safety thing cracked' or 'it's under control. If at any time you believe that, it may have passed you and you may be putting yourself, your colleagues, your passengers and your organisation under threat.

EXERCISE 36: A BUG, WEATHER AND A MISSED APPROACH

The crew's problems began at a Chinese restaurant in Mauritius. The captain, together with his flight deck crew, a co-pilot and flight engineer dined there during a layover before flying on to Bahrain and then to London. The leg from Bahrain to London would be the last portion of a trip that had begun in Brisbane. Several days later, when the flight reached Bahrain, both the co-pilot and flight engineer were racked with gastroenteritis (stomach flu).The captain, however, was unaffected. A Mauritian doctor had given the flight engineer's wife tranquilizers and painkillers. She also was on the trip and had dined with the crew. The doctor had advised the flight engineer to take some of his wife's pills if his symptoms became worse. Flight crews, of course, can't just take advice or prescriptions from any doctor, but this man had been suggested by an airline approved physician, who was too far away but had recommended the examining doctor to the crew. He would soon be added to the airline's list anyway. He did not, however, seem concerned that the crew had been scheduled to fly again in a few days' time.

The subsequent flight to London was not comfortable for the crew. Unexpected headwinds cut into the 747's fuel reserves, and the co-pilot had to leave the cockpit for several hours after taking some of the flight engineer's wife's medicines to control his symptoms. It left the captain to fly a stretch of five hours alone, much of it in the dark.

London fog

Over Frankfurt, the crew heard that the weather at London Heathrow airport was bad. Thick fog meant that they probably would have to execute a Category III instrument approach. In Category III conditions, a 747 is literally landing blind. While the wheels may just have poked out of the fog in the flare, the cockpit, considerably higher, is still in the clouds. Category III approaches are flown by the autopilot, with the crew monitoring the instruments and autopilot performance.

The captain, like most airline pilots, had never flown a Category III approach down to minimums, despite his extensive instrument experience. Neither had the Co-Pilot, new with the airline. He had not even had the mandatory training for a Category III approach, and was not approved to fly one. Still over Germany, the captain communicated with the airline and requested permission for the co-pilot to help out on this one approach into London to get them home. Dispensation was granted. The captain, however, never volunteered the information that his co-pilot was not in the best health. Nobody on the ground enquired either.

Later, the co-pilot testified that nobody had asked him if he wanted a dispensation. But even if he'd been asked, it would have been difficult to refuse. He later wrote to the court. "I personally would not mind if we had diverted. But what would the airline have said to the captain if he had diverted without asking for a dispensation? What would they have said to me if I had not accepted it?"

He really had been in a bind. Wanting to help the airline, wanting to get its passengers home, the co-pilot had agreed to go on with the flight. But he was sick, really. So if the flight would have had to divert because he was too unwell to do a Category III approach, this once, what was he doing on board anyway, dosed up on medicine from an unapproved doctor?

The approach

Nearing London, the 747 was given a routine holding northeast of the airport. After some time in the holding pattern, the flight engineer suggested, “Come on, we’ve got two minutes of holding fuel left, let’s buzz off to Manchester.” The crew discussed the options of both Manchester and Gatwick, their diversion airports, though Manchester had better weather. Just as they were deciding to head off to Manchester, Heathrow called and cleared the 747 for approach.

But a complication had arisen: instead of landing to the east (runway 09), as had been planned, they would now have to turn in shorter and land toward the west (runway 27), because the wind had changed. The approach became a hurried affair. The crew had to reshuffle charts, talk and think through the procedures, revise their mental pictures. A 10-knot tailwind at altitude meant that the 747 was motoring down the approach path toward the runway at an even greater groundspeed. Tightening their slack further still, the approach controller turned the 747 onto the localiser 10 miles from the runway, rather than the normal 12 miles or more. Halfway down, the tower radioed that some approach lights were apparently not working, requiring the flight engineer to take a quick look through his checklist to see how this affected their planned procedure, if at all. The tower controller also withheld clearance for the 747 to land until the last moment, as a preceding 747 was feeling its way through the fog, trying to find its turn-off from the runway.

But the autopilots really were about to become the final straw: they never seemed to settle onto the localizer, instead trundling back and forth through the beam, left to right. When the aircraft turned in to start its approach, the autopilots disconnected for some time and the airplane was flown manually. The autopilots, based on an earlier design, were never really meant for this aircraft, but were “bolted on,” and had to be nursed carefully. On this flight the crew made a later attempt to re-engage the autopilots, though radar pictures showed that the 747 never settled on a stable approach path.

The flight engineer was getting worried about the captain, who had basically been flying solo through the night, and still was alone at the controls. The co-pilot was of little help given his symptoms.

The captain was now technically illegal: trying to fly a Category III approach with autopilots that refused to settle down and function perfectly was not allowed. In hindsight, the right decision, for everybody, would have been to go around and fly a missed approach. But other pilots, some with the same airline, believe the opposite. The captain was concerned about fuel. He had a first officer who was no help. He knew a diversion to Manchester would cost the airline thousands of dollars. He realised he’d be sitting in the chief pilot’s office trying to explain how he got himself into a position that required a missed approach in the first place. He figured the autopilots would settle down.

Ever concerned with passenger comfort, the captain waited before deciding on a go-around. And then he made a gentle one. The 747 sank another 50 feet. The flight engineer glimpsed approach lights out the left window as they started pulling up, away. On climb-out after the first try, the co-pilot noticed how the captain’s hands were shaking. He suggested that he fly the second approach instead, but the captain waved him away. The second approach was uneventful, and was followed by a landing that elicited applause in the passenger cabin.

No safety report

Back in the crew room after they had shut down the airplane, the captain found a note in his company letterbox. It requested that the crew see the chief pilot. The captain told the co-pilot and flight engineer to go home, and he would say that they had already left when he found the note.

But he did not go to the chief pilot either. Nor did he talk to an airline safety investigator about what had happened. Instead, he drove straight home and went to bed. That evening, a call came from the airline. The crew had been suspended.

Discussion question:

Discuss some of the reasons why the captain and crew did not report the incident.

Discuss and compare situations with your colleagues where you have not been sure as to whether a safety report should have been submitted. Discuss the implications of these situations and identify if you would do anything different next time?

EXERCISE 37: THE TRIAL AND EXECUTION

An internal investigation was launched by the airline, who later issued a report chiding the co-pilot and flight engineer. The airline also demoted the captain to first officer. The aviation authority downgraded his licence, and he was relegated to riding out the rest of his career in the right seat, no longer in command.

Six months after the incident, the captain resigned from the airline and began to appeal the authority's reduction of his licence.

Six weeks after the incident, the airline announced that it was no longer granting bad-weather dispensations. But the fleet manager who had authorised the approach with the co-pilot's dispensation was not in the dock. Nor was the controller who turned the aircraft onto a tight approach, from the preceding 747.

It was the pilot who was in the dock. Why had he not filed a mandatory occurrence report right after the flight? Because it did not constitute an occurrence, the pilot argued. After all, he had gone around, or at least initiated a go-around, and landed uneventfully the second time. Why had he gone around so slowly? Because the supposedly canonical technique was not described anywhere, he argued. At some point in the trial, the pilot produced a transcript of every oral call-out, checklist response, and radio transmission that company and government regulations required the crew to accomplish during the approach. It showed that the entire routine took seven minutes. The approach had lasted only four, making it technically impossible to make an approach and follow all applicable rules at the same time.

The pilot was never called to testify on his own behalf and the 747 was dispatched on its next leg out of London without a check of the autopilot, to see if it was somehow faulty.

A split jury found the pilot guilty. The judge fined him only £1,500, and rejected the regulator's demand that he pay £45,000 more to cover court costs. However, the repercussions of the incident on the pilot were significant; three years after the incident, he took his own life.

Discussion question:

Discuss with your colleagues, whether the outcome of this story might have been different had the crew being proactive in reporting the event?

At what stage(s) of their trip could something have been done to avoid the situation they found themselves in on landing at Heathrow?

EXERCISE 38: SAFETY REPORTING AND YOUR WORKPLACE

Describe the process your organisation has in place for reporting unsafe behaviour:

Are you aware of your organisation's safety culture? If so, how would you describe it?

Does your organisation encourage the reporting of safety concerns, without the risk of recrimination or bullying?

If you suspected another pilot of being unfit for duty, what actions would you take?

EXERCISE 39: 'AIRTIME' DISCUSSION

Consider the issue of safety reporting in the 'Airtime' drama, and use the following discussion points as a guide:

Wilko, on his last flight, had bogged the aircraft in soft mud at the end of the runway. He takes his time reporting the incident.

- When should Wilko have reported the incident?
- Is this incident a routinely reportable or immediately reportable incident?
- What are some of the factors that influence flight crew willingness to report safety incidents? Think about a just culture?
- What is a 'just culture' and does your organisation practise this?
- Discuss the relevance of the factors you have identified above, for your own organisation.

Now that you have discussed some of the issues from 'Airtime', make a list of any strategies that you would recommend to the chief pilot for improving the level of safety reporting in your organisation:

Table 36 Your safety reporting improvement strategies

Strategies to improve the effectiveness of safety reporting

Now that you have identified your own strategies, let's find out what the experts think. Play the DVD and select 'Strategies page 2' then 'Safety reporting'. Continue to make further notes in the above table. Discuss with a mentor or peer.

CONGRATULATIONS and WELL DONE! If you have followed the table from page 14 of the *Facilitator Guide*, then you have completed the *Safety Behaviours: Human Factors for Pilots* training. We would appreciate any feedback via humanfactors@casa.gov.au

Answers

This section provides sthe answers to the quiz and tables throughout this workbook

Table 4 Driver fatigue quiz

1. **FALSE**. Stimulants are no substitute for sleep. Drinks containing caffeine, such as coffee or cola, can help you feel more 'alert' but the effect only lasts for a short time.
2. **FALSE**. Sleep is not voluntary. If you're drowsy, you can fall asleep and never even know it. You cannot tell how long you've been asleep.
3. **FALSE**. An open window, or turning the radio on, has no lasting effect on a person's ability to stay awake.
4. **FALSE**. The only safe driver is an alert driver. Even the safest drivers become confused and use poor judgment when they are sleepy.
5. **FALSE**. Sleep is not money. You can't save it up ahead of time and you can't borrow it. But, just as with money, you can go into debt.
6. **TRUE**. The average person needs seven or eight hours of sleep a night. If you go to bed late and wake up early to an alarm clock, you are probably building a sleep debt.
7. **TRUE**. One of the warning signs of a drowsy driver is misjudging surroundings.
8. **FALSE**. Young people need more sleep than adults. Drivers under 25 are at the greatest risk of falling asleep. A third of the victims of fatigue-related crashes are under 25.
9. **TRUE**. If you're driving and your thoughts begin to wander, it's time to pull over and take a break.
10. **TRUE**. Seeing things that are not there is a good indication it's time to stop driving and take a rest.
11. **FALSE**. Driving, especially for long distances, reveals a driver's true level of sleepiness. To be safe, drivers should take a break every two hours.
12. **TRUE**. During a 'microsleep' of 3–5 seconds, a car can travel 100 metres – plenty of time to cause a serious crash.

Table 10 Your knowledge of alcohol

1. 12-ounce beer, a 4-ounce glass of wine and a 1-ounce shot of whiskey all contain the same amount of alcohol?
   TRUE - You can get just as drunk by drinking beer or wine as you can by drinking distilled spirits.
2. A couple of drinks before bed improves sleep quality?
   FALSE - A drink may help you fall asleep faster, but suppresses the hours you spend in REM sleep, reducing overall sleep quality. This causes subjective feelings of tiredness and impaired concentration the next day.
3. Women react differently to alcohol than men, and generally can expect greater impairment from the same quantity of alcohol?
   TRUE - For a number of reasons, women are more susceptible than men to the harmful effects of alcohol. Body size, body composition and metabolism all play a part.
4. Pilots change their drinking patterns when away on a duty?
   TRUE - A NASA study found that short-haul pilots consumed three times more alcohol on trips than at home.

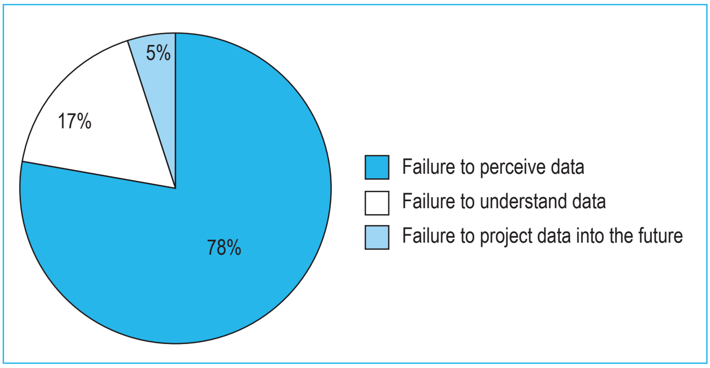
5. Modest amounts of alcohol don't affect your flying?
   FALSE - Even modest amounts of alcohol can impair your flying leading to disorientation and other medical effects. For more information about the effects of alcohol on human performance, go to www.aod.casa.gov.au/aod/health_information/alcohol.html

Table 13 Are you a good listener

Count how many times you answered 'no'. If there are:

- more than 10 – you are a good listener
- 8-10 – you need to make more effort
- fewer than 8 – you might need to do another human factors course.

Table 17 Percentage of contribution towards loss of situational awareness



You can see that a failure to perceive accurate information contributes to incidents and accidents in 78 per cent of the occurrences. Often pilots believed they were performing actions appropriately and making sound decisions for the situations they faced. This is often because they have failed to perceive what is really going on around them.

You might reflect on this next time you fly.

Table 29: Threat and error management quiz

1. The correct answer is (D). Based on the last 25 LOSAs (over 4500 flights in total) in the LOSA Archive, the typical flight (regularly scheduled, normal operations) encounters an average 4.2 threats per flight. Of those, three are likely to be environmental threats and one is likely to be an airline threat. Only 3 per cent of flights encounter no threats whatsoever, while 17 per cent of flights encounter seven or more threats per flight. In other words, multiple threats are the standard and should be considered as such in every flight.
2. The correct answer is (A). Overall, about 40 per cent of all threats occur during predeparture/taxi-out and 30 per cent occur during descent/approach/land. Different types of threats are more prevalent during different phases of flight. For environmental threats (weather, ATC, terrain, traffic, airport conditions), the busiest phase of flight is descent/approach/land, while for airline threats, the busiest phase is predeparture/taxiout. In percentage terms, 43 per cent of all environmental threats occur during descent/approach/land, while 73 per cent of all airline threats occur during predeparture/taxi-out.

3. The correct answer is (A or B). With 4500 flights having an average of 4.2 threats per flight, there are 19,000 logged threats in the LOSA Archive. So which are the most common? Actually, adverse weather and ATC both account for about one quarter of all observed threats, followed by aircraft threats (about 13 per cent of all observed threats) and airport conditions (about 7 per cent of all observed threats).
4. The correct answer is (B). 85-95 per cent of all threats are successfully managed. The average across the Archive is 90 per cent. Put another way, about one-tenth of all threats are mismanaged by the crews, leading to some form of crew error.
5. The correct answer is (B). Mismanagement rates are actually very close for the top three "offenders". Thirteen percent of aircraft threats, 12 per cent of ATC threats, and 11 per cent of adverse weather threats are typically mismanaged. However, when you combine these mismanagement rates with the frequency with which different threats occur, ATC threats emerge as the most problematic threat. In particular, challenging clearances and late changes from ATC are the most problematic of all threats for flight crews. Source: Merritt, A. & Klinect, J. (2006). *Defensive Flying for Pilots: An Introduction to Threat and Error Management*. University of Texas Human Factors Research Project & The LOSA Collaborative homepage.psy.utexas.edu/homepage/group/HelmreichLAB/Publications/pubfiles/TEM.Paper.12.6.0 6.pdf

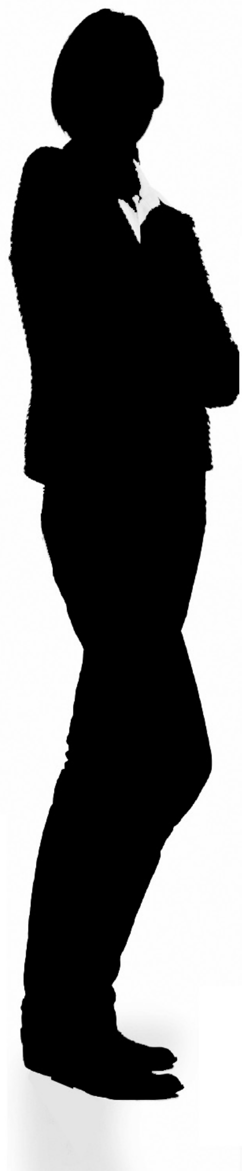
Table 30: Flight crew error management quiz

1. The correct answer is (C). Based on the last 25 LOSAs (over 4500 flights in total) in the LOSA Archive, about 80 per cent of flights have one or more errors – the average is about three errors per flight. Twenty per cent of flights have no observable error.
2. The correct answer is (C). The busiest phase of flight for errors is descent/approach/land. About 40 per cent of all observed errors occur during this phase. Another 30 per cent of errors occur during predeparture/taxi-out when crews are preparing the flight. If you look at the sub-set of errors that are mismanaged, then the rate for descent/approach/land jumps to 55 per cent. Therefore, the most problematic phase of flight where more errors, and more mismanaged errors, are likely to occur is descent/approach/land. This likely makes intuitive sense-errors on the ground aren't as difficult to manage as errors coming down.
3. The correct answer is (B). About one-half of all observed errors are Procedural errors, one-third are aircraft handling, and one-sixth are communication errors. However, this ratio changes dramatically for mismanaged errors. Procedural errors make up half of all errors, but a little less than one-quarter of the mismanaged errors. Three-quarters of all mismanaged errors are aircraft handling errors, with communication errors comprising the remaining few percent.
4. The correct answer is (D). Checklist errors are the most common procedural error, followed closely by callout and SOP cross-verification errors. Briefing errors are less common.
5. The correct answer is (A). About 25 per cent of all errors are mismanaged—6 per cent of all errors lead to additional error and 19 per cent result directly in an undesired aircraft state.
6. The correct answer is (A). Manual handling/flight control errors make up 36 per cent of all mismanaged errors. Automation and system/instrument/radio errors each make up 16 per cent of the mismanaged errors. Checklist errors make up 5 per cent of the mismanaged errors; Crew-ATC communication errors make up 3 per cent of the mismanaged errors. Source: Merritt, A. & Klinect, J. (2006). *Defensive Flying for Pilots: An Introduction to Threat and Error Management*. University of Texas Human Factors Research Project & The LOSA Collaborative

homepage.psy.utexas.edu/homepage/group/HelmreichLAB/Publications/pubfiles/TEM.Paper.12.6.0 6.pdf

Table 31: Undesired aircraft state and their management quiz

1. The correct answer is (C). Despite being the safest form of transport, fully one-third of all flights in the LOSA Archive have an undesired aircraft state. Numbers such as these remind us there is still room for improvement!
2. The correct answer is (A). Almost 20 per cent of all UAS's involve an incorrect aircraft system configuration (they occur on approximately 9 per cent of flights). Speed deviations are next at 16 per cent, followed by lateral/vertical deviations and incorrect automation configuration (each comprises about 13 per cent of all UAS's). These UAS types each occur on approximately 7 per cent of flights.
3. The correct answer is (B). In regularly scheduled, normal operations, 5 per cent of flights involve an unstable approach. What is disconcerting is that only 5 per cent of those unstable approaches result in a go-around, meaning the vast majority of crews decide to continue with the landing, even though they know they are not within specified parameters. Are they choosing to continue the approach because of operational pressure (wanting to save time and fuel), poor airmanship, or foolish bravado? Perhaps some of all three, what do you think?
4. The correct answer is (C). About 30 per cent of all UASs occur as part of a chain of events that starts with a threat that is not managed well and leads to a crew error, which in turn is mismanaged to a UAS. An example would be an airport conditions threat such as poor or faded signage (threat) that confuses the crew, leading them to turn down the wrong runway (error), which results in a runway incursion (UAS). Source: Merritt, A. & Klinect, J. (2006). *Defensive Flying for Pilots: An Introduction to Threat and Error Management*. University of Texas Human Factors Research Project & The LOSA Collaborative homepage.psy.utexas.edu/homepage/group/HelmreichLAB/Publications/pubfiles/TEM.Paper.12.6.0 6.pdf



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