



leadership

communication

decision making

alcohol and other drugs

error management



stress
teamwork
human performance
fatigue

safety behaviours

HUMAN FACTORS

FACILITATOR'S GUIDE

Contacts

For further support on how to get the most from this training resource, please contact your local Aviation Safety Advisor via **131 757** or **safetyadvisor@casa.gov.au**

For more detailed advice on human factors or to provide any general feedback regarding this training resource, please contact our human factors specialists via

131 757 | humanfactors@casa.gov.au | www.casa.gov.au/hf

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safety behaviours

HUMAN FACTORS

FACILITATOR'S GUIDE FOR ENGINEERS

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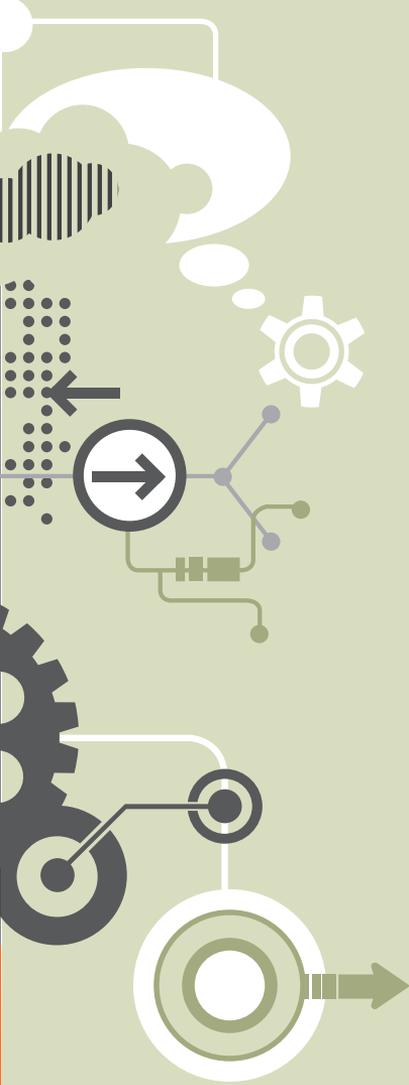
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Introduction

While it is well known that the majority of aviation accidents involve human factors somewhere in the causal chain, it is less well known that between 12 and 20 per cent of aviation accidents may involve maintenance human factors. Managing human factors effectively is an important issue therefore for all maintenance engineers, regardless of what section of the industry they work in.

CASA recently introduced Civil Aviation Safety Regulation (CASR) Part 145, which includes human factors requirements for maintenance. This requirement is consistent with other aviation safety agencies internationally such as the European Aviation Safety Agency (EASA) and the International Civil Aviation Organization (ICAO). CASR Part 145 requires maintenance organisations to apply human factors principles to safety and quality, institute a safety reporting system policy, and ensure that personnel receive training in human factors principles. Training in human factors is required for all employees involved in maintenance, including contract staff.

This practical human factors resource may assist engineers and AMOs to meet the above requirements. Importantly, we hope it will serve as part of your ongoing professional development, so that you keep up-to-date with the latest human factors knowledge.



Overview

The aim of this package is to provide *Safety Behaviours: Human Factors for Engineers* training resources for either facilitated instruction in a group setting, or self-paced learning for the individual aviation engineer.

Ideally, this *Facilitator's Guide* will give you a better understanding of how to use these resources to gain the most value from them.

The logical way to progress through this training is to follow the chapter sequences in the *Resource Guide*, namely:

1. Introduction
2. Error management
3. Human performance and its limitations
4. Decision making
5. Fatigue
6. Stress, workload and time pressure
7. Alcohol and other drugs
8. Communication
9. Teamwork
10. Leadership
11. Professionalism
12. Human factors within an organisation

This provides a logical structure, because the earlier material (that is, error management, human performance) provides the underpinning for later chapters, building the foundation knowledge necessary for an understanding of topics such as decision making and communication. Lastly, an understanding of all these aspects of human factors—knowing your limits, being able to communicate effectively and work together as a team, etc.—maximises your ability to maintain good situational awareness, and make consistently sound decisions, which are in turn, the foundation of professionalism.



What's in your training resource?

As well as this *Facilitator's Guide*, this kit contains a:

- *Resource Guide*, featuring 12 chapters of underpinning theory and case studies providing a deeper understanding of various human factors issues applicable to Australian aviation engineers.
- DVD, featuring a drama: *Crossed Wires* (running time 00.08.24), focusing on a fictitious maintenance organisation, Perfect Twins Maintenance; and a second scenario, the *Right Connection*, which examines how Perfect Twins Maintenance could have done things differently. The DVD also features over 45 minutes of interviews with leading industry experts on the various topics in the *Resource Guide*.
- *Workbook for Engineers*—with practical exercises and further case studies to reinforce participants' understanding of the various human factors issues.
- CD—with electronic copies of the *Resource Guide*, *Workbook for Engineers*, this *Facilitator's Guide*, as well as resources and web links relating to each of the chapters in the *Resource Guide*.
- A PEAR notepad, reinforcing the key human factors areas for engineers.



Now turn to page 6 if you are examining this material in a group setting, or page 14 if you are an individual engineer, undertaking self-paced learning.



Group facilitation: tips for facilitators

This training kit has been designed with either the facilitator of a small group (no more than 8–10 students), or the self-paced individual learner in mind. If as a facilitator, you find your group has more than 8–10 students, you may wish to recommend to them that they find a mentor or tutor in the company (for example, a senior engineer), or a peer doing the same training, so they can discuss the outcomes of the exercises in the *Workbook for Engineers* outside the classroom. By doing this, students can gain a different perspective, and bounce ideas around with someone new.

Generally, there are no definitive ‘right’ or ‘model’ solutions to the scenarios and exercises in the *Workbook for Engineers*. We recommend that in a group setting, however, you reach a consensus between you, the facilitator, and your students.

CASA’s Aviation Safety Advisors in your region are also good points of contact, and are more than willing to discuss the exercises and scenarios with your students. Their contact details can be found on the CASA website at: www.casa.gov.au/avsafety

Recommended group-facilitated learning strategy

- 1** Ensure you have printed sufficient copies of the *Resource Guide* and the *Workbook for Engineers*.

Electronic copies of these are available on the CD.

- 2** Instruct your students to go to the *Resource Guide* and read the introductory chapter 1.

This chapter gives a good overview of the industry need for human factors knowledge and training, and the relevance of human factors to the Australian aviation maintenance environment. This introductory chapter sets the scene, giving students an understanding of the big picture of aviation human factors in Australia.

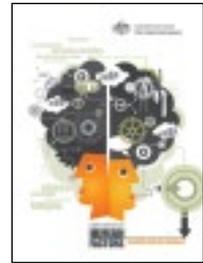
- 3** Watch the *Introduction and Crossed Wires* drama on the DVD.

The drama runs for eight minutes and 24 seconds, and follows what happens at Perfect Twins Maintenance, a small organisation maintaining GA aircraft. *Crossed Wires* highlights various human factors maintenance issues encountered in the hangar on a daily basis, such as error management, fatigue, stress, workload, alcohol and other drugs, leadership, decision making, situational awareness and professionalism.

The drama also looks at external pressures engineers may face: relationship issues, family commitments; finding the balance between work and non-work activities; and organisational factors.

Get your students to watch *Crossed Wires* from start to finish. They will need a copy of the *Workbook for Engineers*, and a pen and pad handy to jot down some of the factors they identify as contributing to the near miss for Perfect Twins' client.

Please note: While *Crossed Wires* has been checked for technical accuracy, it is designed to draw out human factors issues, and should not be relied upon in an operational context.



4 Complete corresponding exercises in the *Workbook*.

Ask your students to go to page 8 of the *Workbook for Engineers* and complete Exercise 1: The PEAR model, and Exercise 2: Recommendations and strategies. They can do this in small groups, tailoring their comments to their own organisation.

5 Follow the chapters in the *Resource Guide*

Now that your students have a good overview of the human factors issues which are part of aviation maintenance engineers' daily lives, you can begin to delve more deeply with them into the areas you have encountered via the DVD drama.

6 Return to the DVD and watch the relevant specialist commentary relating to each chapter.

This series of human factors and industry specialist interviews examines the events which took place at Perfect Twins Maintenance, and focuses on the individual chapter topics, such as error management, fatigue, communication etc.

We recommend that you treat each of the chapters in the *Resource Guide* as self-contained units for your students' ongoing human factors training—have them complete each reading, *Workbook* exercise and review the specialist analysis from the DVD before moving on to the next topic.

You can use the chart on the following pages (pages 10–13) as a progress guide.



Additional material to support exercises

Chapter 8—Communications

Exercise 2

Divide the group into pairs, and allocate one of these shapes to each pair. Photocopy and enlarge the sheet and provide one student from each pair with a shape. One of the pair will describe the shape; the other draws the shape based on the description without seeing it.

The ‘describer’ must not show the shape/s to the person drawing, nor give clues by gesturing with their hands.

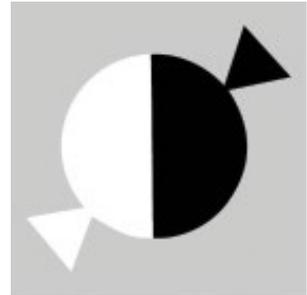
You can increase the level of difficulty by not allowing the person drawing to speak except to say ‘I do not understand’. You may also like to find more complex shapes if this task proves to be too simple.



1



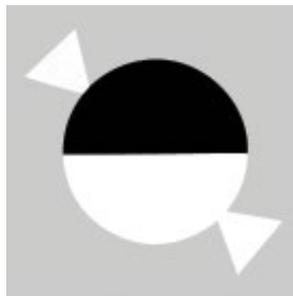
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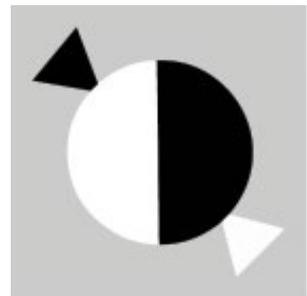
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4



5



6

Chapter 9—Teamwork

Exercise 2

In teams, using only the sheets of newspaper* and sticky tape provided, build a bridge. The bridge must comprise floor-standing supports at each end, and a horizontal span, which must have a clearance of at least 30cm from the floor.

The winning construction will be the one with the longest span between the two floor-standing supports. Any part of the span where there is less than 30cm clearance between the span and the floor will not count towards the measurement.

The span must support objects† you will be given. These objects can be placed anywhere along the length of the span, but must not touch the floor-standing supports.

The floor-standing supports must be free standing (not attached to the floor or any other object or surface), and use of sticky tape as guys from the bridge to the floor, or another object or surface is not allowed.

You will have 30 minutes for planning, building and placing objects on the span.

* The degree of difficulty for this activity can be increased by decreasing the number of sheets of newspaper you provide.

† Provide the group with small objects (2–3 per group—food bars, toys etc) to place on the span.

Overview of topics

Chapter	Activities	Completion
1. Introduction—human factors and maintenance engineers	<ul style="list-style-type: none"> ▪ Read the <i>Resource Guide</i> Chapter 1 Introduction (page 5) ▪ Read the <i>Workbook</i> overview and chapter 1 (pages 9–12) ▪ Turn to Exercise 1 in the <i>Workbook</i> (page 10) ▪ Play the DVD 'Introduction' and <i>Crossed Wires</i> (running time 00.08.24) ▪ Discuss with peer, mentor or facilitator ▪ Complete the <i>Workbook</i> exercises 1 and 2 	Topic complete? <input type="checkbox"/>
2. Error management	<ul style="list-style-type: none"> ▪ Read the <i>Resource Guide</i> Chapter 2 'Error management' (page 27) ▪ Read the <i>Workbook</i> overview and chapter 2 (pages 13–18) ▪ Play the DVD specialist commentary on 'Error management' (running time 00.04.57) ▪ Turn to Exercise 1 in the <i>Workbook</i> (page 14) ▪ Complete the <i>Workbook</i> exercises 1–4 ▪ Discuss with peer, mentor or facilitator 	Topic complete? <input type="checkbox"/>
3. Human performance and its limitations	<ul style="list-style-type: none"> ▪ Read the <i>Resource Guide</i> Chapter 3 'Human performance and its limitations' (page 41) ▪ Read the <i>Workbook</i> overview and chapter 3 (pages 19–26) ▪ Play the DVD specialist commentary on 'Human performance and its limitations' (running time 00.04.58) ▪ Turn to Exercise 1 in the <i>Workbook</i> (page 20) ▪ Complete exercises 1–5 ▪ Discuss with peer, mentor or facilitator 	Topic complete? <input type="checkbox"/>



Chapter	Activities	Completion
4. Decision making	<ul style="list-style-type: none"> ▪ Read the <i>Resource Guide</i> Chapter 4 ‘Decision making’ (page 57) ▪ Read the <i>Workbook</i> overview and chapter 4 (pages 27-32) ▪ Play the DVD specialist commentary on ‘Decision making’ (running time 00.01.20) ▪ Turn to Exercise 1 in the <i>Workbook</i> (page 28) ▪ Complete exercises 1–3 ▪ Discuss with peer, mentor or facilitator 	Topic complete? <input type="checkbox"/>
5. Fatigue	<ul style="list-style-type: none"> ▪ Read the <i>Resource Guide</i> Chapter 5 ‘Fatigue’ (page 69) ▪ Read the <i>Workbook</i> overview and Chapter 4 (pages 33–36) ▪ Play the DVD specialist commentary on ‘Fatigue’ (running time 00.05.16) ▪ Turn to Exercise 1 in the <i>Workbook</i> (page 34) ▪ Complete exercises 1–4 ▪ Discuss with peer, mentor or facilitator 	Topic complete? <input type="checkbox"/>
6. Stress, workload and time pressure	<ul style="list-style-type: none"> ▪ Read the <i>Resource Guide</i> Chapter 6 ‘Stress, workload and time pressure’ (page 91) ▪ Read the <i>Workbook</i> overview and Chapter 6 (pages 37–40) ▪ Play the DVD specialist commentary on ‘Stress, workload and time pressure’ (running time 00.07.10) ▪ Turn to Exercise 1 in the <i>Workbook</i> (page 38) ▪ Complete exercises 1–3 ▪ Discuss with peer, mentor or facilitator 	Topic complete? <input type="checkbox"/>

Chapter	Activities	Completion
7. Alcohol and other drugs	<ul style="list-style-type: none"> ▪ Read the <i>Resource Guide</i> Chapter 7 'Alcohol and other drugs' (page 109) ▪ Read the <i>Workbook</i> overview and chapter 7 (pages 41–46) ▪ Play the DVD specialist commentary on 'Alcohol and other drugs' (running time 00.03.51) ▪ Turn to Exercise 1 in the <i>Workbook</i> (page 42) ▪ Complete exercises 1–3 ▪ Discuss with peer, mentor or facilitator 	Topic complete? <input type="checkbox"/>
8. Communication	<ul style="list-style-type: none"> ▪ Read the <i>Resource Guide</i> Chapter 8 'Communication' (page 127) ▪ Read the <i>Workbook</i> overview and chapter 8 (pages 47–50) ▪ Play the DVD specialist commentary on 'Communication' (running time 00.02.23) ▪ Turn to Exercise 1 in the <i>Workbook</i> (page 48) ▪ Complete exercises 1–5 ▪ Discuss with peer, mentor or facilitator 	Topic complete? <input type="checkbox"/>
9. Teamwork	<ul style="list-style-type: none"> ▪ Read the <i>Resource Guide</i> Chapter 9 'Teamwork' (page 145) ▪ Read the <i>Workbook</i> overview and chapter 9 (pages 51–54) ▪ Play the DVD specialist commentary on 'Teamwork' (running time 00.03.10) ▪ Turn to Exercise 1 in the <i>Workbook</i> (page 52) ▪ Complete exercises 1–4 ▪ Discuss with peer, mentor or facilitator 	Topic complete? <input type="checkbox"/>



Chapter	Activities	Completion
10. Leadership	<ul style="list-style-type: none"> Read the <i>Resource Guide</i> Chapter 10 'Leadership' (page 153) Read the <i>Workbook</i> overview and chapter 10 (pages 55–58) Play the DVD specialist commentary on 'Leadership' (running time 00.02.38) Turn to Exercise 1 in the <i>Workbook</i> (page 56) Complete exercises 1–3 Discuss with peer, mentor or facilitator 	Topic complete? <input type="checkbox"/>
11. Professionalism	<ul style="list-style-type: none"> Read the <i>Resource Guide</i> Chapter 11 'Professionalism' (page 163) Read the <i>Workbook</i> overview and chapter 11 (pages 59–62) Play the DVD specialist commentary on 'Professionalism' (running time 00.03.27) Turn to Exercise 1 in the <i>Workbook</i> (page 60) Complete exercises 1–3 Discuss with peer, mentor or facilitator 	Topic complete? <input type="checkbox"/>
12. Human factors within an organisation	<ul style="list-style-type: none"> Read the <i>Resource Guide</i> Chapter 12 'Human factors within an organisation' (page 171) Read the <i>Workbook</i> overview and chapter 12 (pages 63–66) Play the DVD specialist commentary on 'Human factors within an organisation' (running time 00.06.24) Turn to Exercise 1 in the <i>Workbook</i> (page 64) Complete exercises 1–2 Discuss with peer, mentor or facilitator 	Topic complete? <input type="checkbox"/>

Bonus track on DVD:

'Another perspective' on the Deep Sea Challenge Project (00.03.13)



Answers

(Where appropriate) can be found on pages 67–92 of the *Workbook for Engineers*



Individual self-paced learning

Before commencing your training with this kit, we recommend you establish contact with either a mentor or tutor from within your company (for example, a senior engineer), or a peer undertaking the same training so that you have someone with whom you can discuss the outcomes of the exercises in the *Workbook for Engineers*.

There are no 'model' or right answers to many of the scenarios and exercises in the *Workbook for Engineers*; during group learning, a consensus will be reached between facilitator and students. So that you can derive the greatest benefit from the exercises therefore, we recommend you find someone with whom you can discuss the scenarios.

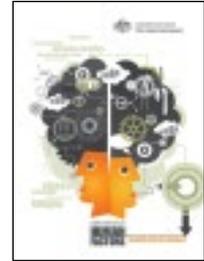
CASA's regional Aviation Safety Advisors are also good points of contact, and are happy to discuss the scenarios with you. Go to the CASA website www.casa.gov.au/avsafety for more details.



Recommended self-paced learning strategy

1 Go to the *Resource Guide* and read the introductory chapter 1.

This chapter gives a good overview of the industry need for human factors knowledge and training, and the relevance of human factors to the Australian aviation maintenance environment. This introductory chapter sets the scene, giving you an understanding of the big picture of aviation human factors in Australia.



2 Watch the *Introduction* and *Crossed Wires* drama on the DVD.

The drama runs for eight minutes and 24 seconds, and follows what happens at Perfect Twins Maintenance, a small organisation maintaining GA aircraft. *Crossed Wires* highlights various human factors maintenance issues encountered in the hangar on a daily basis, such as error management, fatigue, stress, workload, alcohol and other drugs, leadership, decision making, situational awareness and professionalism.



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Please note: While *Crossed Wires* has been checked for technical accuracy, it is designed only to draw out human factors issues, and so should not be used operationally.

3 Follow the chapters in the *Resource Guide*

Now that you have a good overview of the human factors issues which are part of aviation maintenance engineers' daily lives, you can begin to delve more deeply into the areas you have encountered via the DVD drama.

4 Complete the corresponding exercises in the *Workbook for Engineers*

So, begin with page 9 of the *Workbook* and complete Exercise 1: The PEAR model, and Exercise 2: Recommendations and strategies.

5 Return to the DVD and watch the relevant specialist commentary relating to each chapter.

This series of human factors and industry specialist interviews examines the events which took place at Perfect Twins Maintenance, and focuses on the individual chapter topics, such as error management, fatigue, communication etc.

We recommend that you treat each of the chapters of the *Resource Guide* as self-contained units for your ongoing human factors training—complete each reading, *Workbook* exercise and review the specialist analysis from the DVD before moving on to the next topic.

You can use the chart on pages 10–13 of this *Guide* to monitor your progress.



DVD: Human factors specialist panel

Ben Cook	Deputy Director, Human & Systems Performance, ADF
Dr Graham Edkins	HF specialist, Leading Edge Safety Systems
John Garvin	Deep Sea Challenge Project, Project Manager, Sub Internals
Dr Sandy Gordon	Senior Psychologist, University of Western Australia
Dr Ian Hosegood	Chief Medical Officer, Qantas Airways Ltd.
Stuart Hughes	Managing Director, Baines Simmons Australasia
Dr Tony Kerns	HF specialist, CEO Convergent Performance
Gareth McGraw	HF specialist, Civil Aviation Safety Authority
Dr David Newman	Flight Medicine Systems
Derren Rogers	AOD coordinator, Civil Aviation Safety Authority



