

**The University of New South Wales  
School of Aviation**

**AVIA5017 - Human Factors in Transportation Safety**

**2016 Course Outline**

**Course Staff**

The lecturer in charge is Steve Shorrock of the School of Aviation. Steve can be contacted via e-mail at [s.shorrock@unsw.edu.au](mailto:s.shorrock@unsw.edu.au).

**About the Author**

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Senior Lecturer UNSW

Steve is an Adjunct Senior Lecturer with UNSW Department of Aviation. He is a human factors specialist and safety psychologist with a background in practice and research in safety-critical industries. His main interest is human behaviour in safety-related systems and organisations, and safety improvement via cultural and design-led approaches. For around 15 years, Steve has provided consulting, research and training services to major private and public organisations in aviation, rail, chemical, and energy sectors, and at Federal Government level. In this work, he has led HF and system safety projects, for high-profile multi-million dollar transport infrastructure projects as well as smaller projects. Steve has had previous Senior and Principal industry roles in National Air Traffic Services/NATS (UK), Det Norske Veritas/DNV Consulting (UK), and Railcorp (AU). He is currently Safety Human Factors specialist at EUROCONTROL where he leads the European Safety Culture Programme and projects relating to incident investigation and human performance in air traffic control. Steve is a registered member of the Institute of Ergonomics and Human Factors and a Chartered Psychologist with the British Psychological Society.

**Course Information**

Behind every output of every transport organisation is a set of people. People design, build, operate, maintain, and manage trains, aircraft, vessels, road vehicles, and related vehicles and infrastructure. The discipline of human factors, also known as ergonomics, is about these people, attempting to improve the fit between them and their tasks, tools, technology and working environments. Human factors aims to increase efficiency and effectiveness, and at the same time satisfy several human values such as safety, comfort, and job satisfaction. To achieve these aims, human factors draws from many disciplines, such as psychology, physiology, anatomy, design, and engineering.

Human factors is of concern to *everyone* involved in or affected by transport operations – no matter what their role. Employees, shareholders, customers and the general public benefit from safe operations, greater efficiency, more comfort, and increased satisfaction. Additionally, a number of individuals within such organisations have some kind of formal responsibility for human factors, at some level. These people include directors, managers, safety investigators, auditors, designers, and engineers, as well as human factors specialists/ergonomists. Too often it is the case that human factors issues in transportation are only brought to the fore after tragic accidents such as the 1987 Herald of Free Enterprise capsized, the 1999 Ladbroke Grove train crash, and the 2002 Überlingen mid-air collision. Also, thousands of accidents occur every day on the roads; the human factors issues involved are rarely remembered for long, except by the bereaved. However, the vast majority of time we experience safe operations, and people are at the heart of those too. Often people rescue a situation that could have been a disaster. All of these situations are of relevance to this course.

This course takes a 'lifecycle' approach to the study of human factors in transportation. After a review of the fundamentals of human performance, human factors issues in design, operation, maintenance and management are reviewed with an aim of helping students develop a deeper and broader understanding of this interesting and important discipline and its application across transportation modalities. We will look at both normal and abnormal operations and hope that by looking at how things can be designed right, we may be able to prevent things going wrong, and vice versa.

### *Aims*

The aim of this course is to help students develop an applicable understanding of human factors issues, and their relevance throughout the lifecycle of transportation systems.

### *Learning Outcomes*

On successful completion of this course you should be able to:

- describe the aims and philosophy of human factors;
- describe some key frameworks for understanding human factors issues;
- discuss the capabilities and limitations of human performance, including key individual differences;
- identify and discuss key human factors issues that affect:
  - system design, including display and control systems and working environments;
  - operation, including tasks and jobs, and procedures and training design;
  - maintenance, including routine maintenance and disturbance recovery;
  - management, including human factors integration, risk management, safety management systems, audits, and investigations; and
- apply this knowledge to day-to-day transportation operations.

### *Location*

This course runs for the duration of Semester 1.

The course is delivered via distance education. Course materials are supplied.

### *Learning and Teaching Philosophy*

This course provides an overview of human factors issues as they affect transportation operations. After an introduction to human factors and a basic grounding in human performance concepts, the course takes a lifecycle approach, examining human factors issues in design, operation, maintenance, and management. Many of the concepts discussed throughout the course are actually applicable to transportation (and industry) generally, but the examples drawn will come primarily from rail, aviation, maritime, road and even space transport. The main focus of the course is on commercial, rather than private, transportation.

This course aims to provide an academic environment in which students are actively engaged in the learning process. The course aims to be interesting, challenging and enjoyable. Activities are linked to both research and scholarship, and the real world, and allow students to reflect on how system safety issues affect them and others in the aviation industry. Student diversity in terms of experiences and learning styles is valued. A supportive environment is provided but there is an expectation that students will take responsibility for their own learning and also learn co-operatively with their peers. Student assessment is designed to reflect the learning outcomes, and meaningful and timely feedback will be provided on coursework.

### *Internet*

Online content and study materials can be accessed via UNSW Moodle:  
<http://www.telt.unsw.edu.au>

### **Assessment**

The MScTech (Aviation) Program's approach to assessment closely follows that of the Australian Open Learning Program of the Australian Graduate School of Management. At all times assessment is intended to form a component of the learning process and assignments are designed to encourage you to apply what you learn to your own experience, organisation or the transportation industry. The assignments will be assessed on the basis of how you apply subject material to gaining new insight into your or another organisation. Written comments will be provided on your assignment and should provide useful feedback.

### *Criteria for Assessment*

	<b>Design of...</b>	<b>Examples</b>
<b>Group 1</b>	a control, input device, instrument or tool OR,	touch pad or lever, train radio, control panel
	a display, sign or warning system OR,	alarm display, situation display, sign, ground-proximity warning system or car parking sensor
	a workstation, control room, vehicle interior or other working environment	train controller's workstation, ship's bridge, air traffic control tower, cockpit, vehicle interior
<b>Group 2</b>	a task or activity OR,	train shunting, aircraft pull-back
	a job or role	pilot, long distance lorry driver
<b>Group 3</b>	a formal procedure, checklist, policy, method or work system OR,	checklist or procedure, safety management system, accident investigation interview method
	training	crew resource management, ab initio training

The assignment should be structured in three parts. For each part, first describe the design and your experience of it. The design and experience should relate to transportation (aviation, road, rail, maritime – one or several modes), and your role either as a professional within the industry (e.g. operator/end user, maintainer, designer, manager, investigator/assessor), or as a passenger or user (e.g. regarding signage), or as a customer or member of the public. Again, your three experiences must reflect at least two transportation modes, and may relate to normal operations or non-normal operations (e.g. an incident). You are encouraged to provide photographs or illustrations as appropriate, if you have permission to do so.

Once you have identified and described the design and experience, discuss the associated human factors issues. Apply the concepts you have encountered in the course and your reading and provide support for your evaluations from the human factors literature, for instance highlighting any human factors principles that are violated, any applicable theories or findings, etc. You may also expand your analysis to relate to other, better known events, e.g. accidents involving similar issues. It is vital that you use the academic literature to provide evidence for your arguments (in addition to any industry literature you cite).

It is recommended that your structure your assignment roughly as follows:

Title page and details

Introduction

Design 1 (short descriptive title)

Design 2 (short descriptive title)

Design 3 (short descriptive title)

Conclusion

References.

The word-count should include everything **except** the cover sheet, title page and list of references.

## Referencing

Provide full references for all reference sources that you cite (e.g. journal articles, books, conference papers, official websites, reports) using the American Psychological Association (APA) referencing system. See UNSW's Learning Centre website for details. Marks will be deducted for failure to adhere to APA requirements.

## Course Content

Unit 1	Introduction to Human Factors in Transportation
Unit 2	Human Performance Concepts 1: Individual Performance – Applied Cognitive Psychology
Unit 3	Human Performance Concepts 2: Individual Performance – 'Human Error' and Performance Variability
Unit 4	Human Performance Concepts 3: Group Performance
Unit 5	Human Performance Concepts 4: Individual Factors Affecting Performance
Unit 6	Human Factors in Design 1: Display and Control Systems
Unit 7	Human Factors in Design 2: The Working Environment
Unit 8	Human Factors in Operation 1: Task and Job Design
Unit 9	Human Factors in Operation 2: Procedures and Training Design
Unit 10	Human Factors in Maintenance 1: Routine Maintenance
Unit 11	Human Factors in Management 1: Integrating Human Factors (Proactive)
Unit 12	Human Factors in Management 2: Integrating Human Factors (Reactive)

This course provides an overview of human factors issues as they affect transportation operations. After an introduction to human factors and a basic grounding in human performance concepts, the course takes a lifecycle approach, examining human factors issues in design, operation, maintenance, and management. Many of the concepts discussed throughout the course are actually applicable to transportation (and industry) generally, but the examples drawn will come primarily from rail, aviation, maritime, road and even space transport. The main focus of the course is on commercial, rather than private, transportation.

Unit 1 provides an introduction to human factors, examining some definitions and terminology, philosophy of human factors and a brief history of human factors. This

unit also introduces some simple human factors frameworks, to help integrate some of the later material.

Units 2 to 5 introduce human performance concepts. Unit 2 introduces individual performance, examining the cognitive and motor processes involved in human performance. This is core to the whole course. Unit 3 goes on to examine the concept of 'human error' and performance variability. 'Human error' is really just human performance with unwanted results. However, so much is written about human error that it is necessary to cover the topic in some detail. Individuals don't perform in a vacuum; so Unit 4 examines group performance and social issues – namely communication, teamwork and culture. Unit 5 looks briefly at some individual differences that affect performance, such as age, experience, attitude, health and fatigue.

Units 6 and 7 examine human factors in design. In many ways, the whole course is about design, but the emphasis here is on the design of hardware/software systems and the working environment. Unit 5 looks at display and control systems, including visual and auditory displays, and automation. Unit 6 moves on to the working environment, including workspace design, seating, control centres, passenger environments and the ambient environment.

Units 8 and 9 look at human factors in operation. Unit 8 examines the design of tasks and jobs. Unit 9 concentrates on the design of training and procedures.

Unit 10 focuses on human factors in routine maintenance, such as maintenance procedures, inspection, shiftwork for maintenance, shift handover, and permits to work.

Finally, Units 11 and 12 examine human factors in management, and management of safety in particular. Unit 11 takes a proactive approach, examining human factors integration into system design, safety management systems, and risk assessment. Unit 12 looks at integrating human factors reactively, concentrating on human factors in safety investigation.

In summary, Units 1 to 5 examine the concepts of human factors, and Units 6 to 12 examine the application of these concepts to design, operation, maintenance and management. You will notice that some of the initial concepts are often developed further in context later on.

You will also notice that exercises, readings, web-links (e.g. short news articles) and accident examples have been integrated into the course and/or via Moodle and other methods of communication. Exercises are optional and so are not assessed but are recommended.

The approach taken in this course is not solely via the orthodox topic-by-topic way that you may see in some human factors textbooks. This is because you are probably not a human factors specialist, but rather your responsibility is for design, operation, maintenance, management, or a mixture of these, and in any case an appreciation of all these areas is needed in order to manage safety in transportation

effectively. The 'lifecycle' approach of this course is intended to facilitate safety management in transportation.

## Resources for students

### *Books*

There is no prescribed text for this course. All recommended readings have been included within each unit. Note that a large selection of readings has been included to provide students with an adequate 'library' from which to approach the course. It is not expected that students read all the readings, but rather that students select those readings most appropriate to their assignment. This is to allow distance education to take place anywhere in the world at a reasonable cost and with equitable access to resources. However, students may wish to purchase one or more texts to further their understanding of this subject. Unfortunately, there is no appropriate text on 'human factors in transportation' as such, but there are generic texts and a few that are specific to certain modes. A few of the most suitable, in terms of content, availability and affordability, are listed below under various categories. While some of the books are focussed on one modality, those that are textbooks do apply more generically throughout the transport industries.

Norman, D. (2002) *The design of everyday things*. Basic books, 288 pages. This book is an enjoyable read for anyone interested in the psychology and ergonomics of design. It is highly recommended. It is particularly applicable to Assignment 2.

Wickens, C., Lee, J., Liu, Y., Gordon-Becker, S. (2003). *Introduction to human factors engineering: International edition* (2nd Edition). Pearson. ISBN 0131229176, 608 pages. This is a thorough textbook which covers many theoretical issues within human factors design. The material may be relevant to both assignments.

Matthews, G., Davies, D.R., Westerman, S.J., and Stammers, R. (2000). *Human performance: Cognition, stress and individual differences*. Hove, UK: Psychology Press. ISBN 0415044073, 398 pages. This is an excellent book for the more theoretical aspects of the course, especially the initial units.

Many other texts are available, some relating to a particular transport modality, and can be searched easily via a search engine or online book stores. Please ask for recommendations.

Other texts that may be of assistance are extracted in the various sections to each unit. You may find that some of these extracts are also useful references in other units within this course.

### *Journals*

Journals articles are, in many ways, the best reference sources. There are many journals dedicated to human factors. These can be accessed (usually electronically) via UNSW Library website – SIRIUS. The most relevant include:

- Human Factors
- Ergonomics
- Applied Ergonomics
- Theoretical Issues in Ergonomics Science
- Human Factors and Aerospace Safety
- Cognition, Technology and Work
- Safety Science
- Journal of Safety Research
- International Journal of Aviation Psychology
- Accident Analysis and Prevention

### *Internet*

Many websites are of use this course. The following provide just a few useful resources such as reports, magazines, articles, information, accident databases, legislation, fact sheets, and links:

#### Ergonomics Societies and Associations

- Institute of Ergonomics and Human Factors (UK) [www.ergonomics.org.uk](http://www.ergonomics.org.uk)
- Human Factors and Ergonomics Society (USA) [www.hfesa.org](http://www.hfesa.org)
- Human Factors and Ergonomics Society of Australia [www.ergonomics.org.au](http://www.ergonomics.org.au)

#### Ergonomics Databases

- Ergonomics Abstracts (a database of human factors/ergonomics publications). Access via UNSW Library website <http://www.library.unsw.edu.au/> then go to SIRIUS)

#### Aviation

- Flight Safety Foundation [www.flightsafety.org](http://www.flightsafety.org)
- Civil Aviation Safety Authority [www.casa.gov.au](http://www.casa.gov.au)
- Eurocontrol [www.eurocontrol.int](http://www.eurocontrol.int) (see also
- Federal Aviation Administration (US) [www.faa.gov](http://www.faa.gov)
- Air Accidents Investigation Branch (UK) <http://www.aaib.dft.gov.uk>
- Aviation Safety Network <http://aviation-safety.net/database/>

#### Rail

- Railway Safety and Standards board (UK) [www.rssb.co.uk](http://www.rssb.co.uk) (see also <http://www.rssb.co.uk/humanf.asp>)

#### Maritime

- Australian Maritime Safety Authority [www.amsa.gov.au/](http://www.amsa.gov.au/)
- European Maritime Safety Agency <http://www.emsa.eu.int/>
- Maritime and Coastguard Agency (UK) <http://www.mcga.gov.uk/>



## Road

- Roads and Traffic Authority, NSW <http://www.rta.nsw.gov.au/roadsafety/index.html> (see other authorities for other states)
- Royal Society for the Prevention of Accidents <http://www.rospa.com/roadsafety/>

## All Industries/General

- Australian Transport Safety Bureau [www.atsb.gov.au/](http://www.atsb.gov.au/)
- Queensland Transport <http://www.transport.qld.gov.au/safety>
- UK Transport Research Laboratory <http://www.trl.co.uk/>
- UK Health and Safety Executive [www.hse.gov.uk](http://www.hse.gov.uk)
- Bad designs [www.baddesigns.com](http://www.baddesigns.com)
- BBC Online <http://news.bbc.co.uk> (see also <http://news.bbc.co.uk/onthisday/hi/themes/default.stm>)

Students who find other good sites may pass on the URL via Moodle Discussions.

## Academic Honesty and Plagiarism

Plagiarism is the presentation of the thoughts or work of another as one's own<sup>1</sup>. Examples include:

- direct duplication of the thoughts or work of another, including by copying work, or knowingly permitting it to be copied. This includes copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement;
- paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and,
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.<sup>2</sup>

Submitting an assessment item that has already been submitted for academic credit elsewhere may also be considered plagiarism.

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<sup>1</sup> Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle.

<sup>2</sup> Adapted with kind permission from the University of Melbourne.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does not amount to plagiarism.

Students are reminded of their Rights and Responsibilities in respect of plagiarism, as set out in the University Undergraduate and Postgraduate Handbooks, and are encouraged to seek advice from academic staff whenever necessary to ensure they avoid plagiarism in all its forms.

UNSW Academic Skills and Support website provides information on plagiarism and academic honesty. It can be located at:

<https://student.unsw.edu.au/plagiarism>

Also the Learning Centre <http://lc.unsw.edu.au/> provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

1. correct referencing practices;
2. paraphrasing, summarising, essay writing, and time management;
3. appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

### **Informal feedback**

As well as the formal assessment procedure, every attempt will be made to give informal feedback during the course. You must log into Moodle regularly.

### **Learning Assistance**

You are strongly encouraged to make full use of The Learning Centre, either in the Library for information on essay and assignment writing and referencing.

### **Continual Course Improvement**

Periodically, student evaluative feedback on the course is gathered, using among other means, UNSW's Course and Teaching Evaluation and Improvement (CATEI) Process. Student feedback is taken seriously, and continual improvements are made to the course based in part on such feedback. Significant changes to the course will be communicated to subsequent cohorts of students taking the course

## **Teaching Strategies**

The MScTech (Aviation)/MAvMgmt and its associated programs, the Graduate Certificate in Aviation Management and the Graduate Diploma in Aviation Management, are offered through distance education and have been specifically designed for students who are unable to attend weekly sessions at the university. The MScTech (Aviation)/MAvMgmt is targeted towards professionals and managers who work in aviation related environments.

## **Administrative Matters**

Students should be familiar with the information contained in <https://my.unsw.edu.au> regarding expectations of students, assignment submission, examination procedures, equity and diversity and other policies that affect you. A Postgraduate Aviation Student Guide can be obtained from the School of Aviation which is also available on UNSW Moodle. Please contact Jamie Lim at [jamie.lim@unsw.edu.au](mailto:jamie.lim@unsw.edu.au) for any administrative enquiries.