

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

AVIA5039 – Airworthiness for Transport Category Aircraft

2016 Course Outline

Course Staff

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About the Author/Facilitator

John has extensive airline engineering and maintenance experience over a professional career spanning more than 40 years, including more than 25 years in executive, general and accountable airworthiness management roles in large airline Engineering and Maintenance organisations.

He is an Aeronautical Engineer, having worked in airline technical services (structures and systems), aircraft performance, fleet assessment and aircraft acceptance/delivery roles. He has filled senior engineering, maintenance, fleet development, safety, quality and risk management roles including holding various National Aviation Authority (CASA) approvals and has led the Engineering and Maintenance businesses of Air Pacific in Fiji and Ansett Australia and Qantas Airways Ltd in Australia.

His main career focal areas have been business strategy, business process improvement, change management, governance, regulatory compliance, operational and occupational safety systems, risk management, leadership development, employee engagement/communication and relationship management.

He is Chairman of the Board of the Qantas Foundation Memorial Ltd, President of the Royal Aeronautical Society Australian Division and Adjunct Professor with the School of Aviation, University of NSW. He is now an executive consultant providing services to the aviation and broader engineering communities.

Course Information

Airworthy means that an aircraft is in conformance with its approved design and that it is in a state that is suitable for safe flight. As a concept this is straightforward and readily comprehended and it is absolutely reasonable that aircraft crew, passengers and those on the ground should expect to be able to take the airworthiness of aircraft as a given. This is particularly so when dealing with aircraft that are involved in air transport operations and with those operators that provide air transport services. This is an industry that is highly regulated and monitored, utilises state of the art technology, is dominated by major industrial players that have access to the most sophisticated design and manufacturing techniques and, for the most part, aircraft operators that have made a very large investment in aircraft, facilities, highly skilled personnel and in their company brand. Such operators could find themselves in a position where their survival or failure could be based upon their safety reputation.

However, what does airworthiness really mean and what does it take in practice to achieve and sustain particularly for large, complex Transport category aircraft supported and operated by large, complex organisations?

Airworthiness is at the core of aviation safety. It is a constant and vital thread that runs all the way from the initial aircraft conceptual design through the detailed design, prototype testing and certification, manufacture, entry into service, sustained and reliable operations in-service, maintenance, repairs and modification throughout its operating life and ultimately to aircraft disposal.

Travel by air is the safest mode of transport in terms of distance travelled and, given the technological complexity involved, is extremely reliable. When serious accidents do occur however there is often a significant loss of life and associated extensive public concern and, appropriately, an intense focus on investigating and determining the root cause of the accident and rectifying that.

Whilst it is not usual for an airworthiness issue to be a primary accident cause when it is shown to be so, or when it is a significant contributory factor, there is reason for immediate and grave concern. This is because unlike, say, an air traffic control or flight crew error or extreme adverse weather event the cause of which is more likely to have originated with one or a small group of individuals or from an isolated system failure such as an operator's training regime, the tentacles of an airworthiness deficiency may be difficult to trace and could spread far and wide. For example:

- A design flaw will probably affect the entire global fleet of that aircraft/engine type;
- Similarly, an oversight during the flight testing/certification stage that, say, ultimately manifests itself as a shortfall in aircraft performance or that is caused by the inadequate specification of a critical certification maintenance requirement, will also possibly affect the entire world fleet;
- A manufacturing defect that has recurred without detection may also affect a large proportion or all of the global fleet;
- An inadequately or incorrectly specified maintenance schedule may impact multiple operators, especially if it originated during the process of placing a

new aircraft or engine type into service when the operators were coordinating with the manufacturer to produce the baseline maintenance specification;

- A systemic error or deficiency in performing maintenance, repairs or modifications by a maintenance organisation is also likely to have affected multiple aircraft and possibly multiple operators. What's more, the extent and seriousness of such a deficiency across all the potentially affected aircraft may be difficult to ascertain as it may vary with the way the job was done and the personnel who were involved from one aircraft to the next.

A recent example of a major airworthiness issue is the difficulty that Boeing and customer airlines experienced when fires occurred in B787 lithium-ion batteries. Fortunately this did not lead to an accident and there were no fatalities, however there was significant operator disruption because the fleet was grounded and new production and aircraft deliveries halted. Once a suitable battery installation redesign was developed, tested and validated production was able to recommence and operations began after the in-service aircraft were modified.

In this Course we consider each of these major phases that together constitute airworthiness, as identified above. These phases are grouped under two descriptive headings, referred to as Initial Airworthiness and Continuing Airworthiness. The focus is on the concepts, principles, regulations, organisational processes and systems that enable airworthiness to be initially attained and subsequently sustained throughout the aircraft's life. In turn we then focus on the responsibilities and accountabilities of the managers and key personnel who make all this happen day-to-day, as these may well be the roles that graduates of this Course ultimately occupy.

Aims

The aim of this 6 UoC course is to provide an understanding of the international and national frameworks, underlying principles, regulatory requirements, processes, terminology, governance and implementation challenges presented by the regulatory, business and societal expectations associated with initial and continuing airworthiness. It is relevant to those involved in the operation of Transport category aircraft including regulators, engineers, maintainers, schedulers, operations controllers, general managers and those holding accountable roles. It is based around the regulatory systems and concepts of the Australian, European and U.S. environments. Areas covered include relevant regulations, design, certification, entry-into-service, continuing airworthiness compliance, conformance and change management, managing acquittal of work, maintenance organisations and logistics and inventory management.

Learning Outcomes

On completion of this course students should have:

- An understanding of the international and national framework and regulations covering airworthiness;
- An understanding of safety, quality and risk management systems and of compliance and conformance in relation to airworthiness;
- a sound appreciation of the initial airworthiness concepts and principles involved in aircraft design, production, testing, certification and aircraft entry-into-service;
- a sound appreciation of the concepts, principles and obligations associated with planning, monitoring and sustaining continuing airworthiness for the operational life of an aircraft;
- an understanding of the key factors that determine how maintenance is planned, acquitted, certified and tracked;
- a full appreciation of airworthiness management responsibilities and accountabilities and how to go about meeting these obligations.

Location

This course runs for the duration of Semester 1.

The course is delivered electronically via UNSW websites, on a distance-learning basis. The core component of delivery is the course manual. The AVIA5039 course manual was written by the current course facilitator. The course manual approach allows students to study at their own pace, in accordance with their particular work schedules and locations. The course manual provides a considerable range of articles, references and case studies the student can absorb. Academic review and feedback is delivered via e-mail or Moodle, an online learning and teaching platform.

Learning and Teaching Philosophy

This course is designed for mature students undertaking study at the Masters level with either a first degree or substantial industry experience. It builds upon existent knowledge within aviation or a related discipline to provide an interesting yet challenging learning environment. Although students study individually via distance learning, interaction with the course facilitator and other students is encouraged through the UNSW Moodle. Students are encouraged to manage their time effectively. The course caters for a range of learning styles. Assessment tasks are designed to be rewarding educational experiences with formative feedback in time for preparation of the final assessment.

Integration into Overall Program

The course relates to several other courses offered as part of the Master of Aviation Management that relate to aviation law and regulation, risk and safety management, aircraft operations, airline management and human factors in aviation. This course focuses on establishing and sustaining safe, compliant and reliable transport aircraft operational capability.

Internet

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

Course Schedule and Outline

The course comprises 12 units to match the course duration.

Unit 1	Introduction and Overview
Unit 2	Regulatory Framework and Structure
Unit 3	Airworthiness Compliance – Concepts and Processes
Unit 4	Initial Airworthiness
Unit 5	Operator First of Type Entry into Service
Unit 6	Continuing Airworthiness – Governance and Change Management
Unit 7	Continuing Airworthiness – Planning, Monitoring and Improvement
Unit 8	Continuing Airworthiness – Acquittal of Work
Unit 9	Approved Maintenance Organisations – Establishment and Approval
Unit 10	Approved Maintenance Organisations – Perform Work
Unit 11	Inventory And Supply Management
Unit 12	The Airworthiness Management Process

The twelve units of the course are designed to develop a broad knowledge of applied airworthiness and compliance.

Unit one - Introduction and Overview – this unit sets the context for Transport category aircraft operations and explains what airworthiness means, how it has evolved and the role it plays in safe operations. Given the significant part that compliance plays in airworthiness, the framework of airworthiness regulation is also introduced.

Unit two - Regulatory Framework and Structure – considers the international and national airworthiness regulatory framework and structure; its objectives, the

requirements that must be met and approvals gained in order to function in this industry.

Unit three – Airworthiness Compliance-Concepts and Processes - examines the systems and key mechanisms that an organisation uses to provide assurance of compliance and conformance with the regulations and standards; and with its own procedures, standards and requirements; and concepts and terminology are explained.

Unit four – Initial Airworthiness - introduces the four main stages that together provide an understanding of the initial airworthiness process: design, certification, production (manufacture) and the maintenance concepts associated with aircraft acceptance and entry into service. As each of these stages is considered the key concepts and aspects associated with each are described.

Unit five - Operator First of Type Entry into Service – there is considerable overlap between the initial and the continuing airworthiness obligations of the holder of the Type Certificate and the Operator when a new aircraft is acquired. This unit considers those issues and actions that a person responsible for the future continuing airworthiness requirements of a fleet must consider and have in place to meet the regulator's and senior management's requirements and how they must work collaboratively with the State of Design and State of Registry National Aviation Authorities to ensure a smooth and compliant entry into service.

Units six through eight – Continuing Airworthiness – these three units address the critically important and ongoing role and functions of the Operator's organisation and the individuals who manage airworthiness through the operating life of the aircraft. Areas covered include the setup, governance and responsibilities of the continuing airworthiness organisation; how it manages change, plans maintenance and monitors compliance; brings about continuous improvement in airworthiness and ensures that the mandated work is actually done.

Units nine and ten – Approved Maintenance Organisations – these units consider what is required to set up and have a maintenance organisation approved, including scoping the breadth and depth of activities to be undertaken and consequently acquiring all the required resources and wherewithal to acquit that work.

Unit eleven – Inventory and Supply Management - considers the vital role that the provisioning of aircraft parts, parts repair and materials management contribute to airworthiness. Without adequate inventory, continuing airworthiness will always be compromised, either directly or indirectly by the workforce trying to compensate for the shortcoming. At least 50% of maintenance expenditure will be on inventory and sub-contracted services so this is also an attractive area for fraudulent or other unscrupulous activities that could compromise airworthiness and it must be closely managed.

The final unit – The Airworthiness Management Process - consolidates all that preceded it and considers airworthiness from the perspective of an integrated management process. Whilst this is an over simplification of what is a complex system this approach does enable the key functions, responsibilities and

Essays and Final Assignment

Essays and the Final Assignment must be written as proper academic papers and will be marked in accordance with normal academic conventions/standards. Characteristics associated with competent essays are:

- evidence of understanding of the concepts, principles, requirements and best practices considered in the course;
- comprehensive and appropriate coverage of relevant issues for the given topic, addressing the specified assignment requirements;
- where appropriate, the incorporation of brief personal, professional experience to illustrate important issues;
- ability to structure a logical presentation of information and argument concisely and accurately written within the stipulated length;
- appropriate use of reference material, evidence of research and deliberations beyond the course notes and appropriate and correct referencing (see below); and
- appropriate acknowledgement of material, to avoid issues with respect to plagiarism.

Students who do not comply with these general criteria are unlikely to receive a passing grade for the course. It is acknowledged that many students undertaking AVIA5039 are working professionals, sometimes without previous substantial academic exposure; however students are expected to demonstrate an understanding of the subject matter and to adopt academic conventions, such as consistent referencing.

Late submission of Essays will only be allowed in exceptional circumstances and must be agreed IN ADVANCE with the course facilitator.

Final Assignment

The purpose of the Final Assignment is to test the comprehensiveness of your overall understanding of Transport category airworthiness and how to manage airworthiness in an actual operating environment.

The Assignment question(s) will not be a test of facts but of concepts and applied learning and will require a thorough understanding of the Course content across the units. You will be able to access references etcetera, but the questions posed will not be of the style that enable you to 'find' the answer on the internet. To do well you are encouraged to absorb the Readings of the course, consult the References and explore some of the topic areas further through your own research. You are also encouraged to think deeply about your legal and societal obligations as an accountable manager responsible for ensuring the safety of aircraft.

The end-of-course Assignment must be submitted by the stipulated time and late submission is not acceptable.

All assignments should be submitted electronically in Word, Rich-text or Acrobat format to the School of Aviation submitted through the Assignment Submission Box on the UNSW Moodle site.

If you are not clear about what is required of you then it is your responsibility to contact the course facilitator as soon as possible – and certainly well before the due date for an assessment task. *Normally, extensions for assignments are not provided after the due date.*

Final Course Result

All final course marks are scaled by the School and reviewed by the Faculty. The final approved course result will be officially released on myUNSW. Students should not predict their final official marks directly from each assessment task, even after all the marks for each assessment are received.

Referencing

Either the Harvard or Oxford (Footnote/Bibliography) referencing systems are acceptable, but choose one and stay with it. Note that correct referencing also applies to any (brief) quotations or references to Course Notes (such as this AVIA5039), which must be appropriately cited.

Academic Honesty and Plagiarism

Plagiarism is the presentation of the thoughts or work of another as one's own¹. 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

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

- claiming credit for a proportion of work contributed to a group assessment item that is greater than that actually contributed.²

Submitting an assessment item that reuses significant content of your own work that you have previously submitted for academic credit elsewhere is also considered to be plagiarism. If you wish to reuse such work you must acknowledge that you are doing so or cite the original work.

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.

² Adapted with kind permission from the University of Melbourne.

References and Resources

Text Books

Prescribed: There are no prescribed textbooks for this course.

Recommended:

A text recommended as being useful for this course and for students with a professional interest in airworthiness is:

Kinnison, H., Siddiqui, T. (2013) *Aviation Maintenance Management* (2nd ed.) McGraw-Hill.

Whilst not a text book *per se*, *Aviation Safety Investigation BS/20010005 Investigation into Ansett Australia maintenance safety deficiencies and the control of continuing airworthiness of Class A aircraft* conducted by the Australian Transport Safety Bureau is a very comprehensive document on this subject area. It contains extensive background material, discusses many of the subject areas covered in this course and includes useful graphics and various extracts from relevant publications. It also contains many appendices that include excerpts from the most relevant ICAO Annexes. It is accessible online at:

http://www.atsb.gov.au/publications/2002/sir200211_001.aspx

Journals and Magazines

Journals/magazines that you should become acquainted with include:

- *Flight Safety Australia*, Civil Aviation Safety Authority, Australia.
http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_93249
- *AeroSafety World Magazine*, Flight Safety Foundation.
<http://flightsafety.org/aerosafety-world-magazine>
- *Boeing Aero Quarterly*, Boeing Commercial Airplane Company.
<http://www.boeing.com/commercial/aeromagazine/>
- *FAST*, Airbus technical magazine.
<http://www.airbus.com/support/publications/>

You may also be able to access articles from the first two of these journals via the UNSW online library.

Training Resource

The Civil Aviation Safety Authority, Australia (CASA) has a number of educational resources located on their website under the Education tab. Content relevant to this Course includes training resources covering Human Factors and Safety Management Systems and in the e-Learning Catalogue information covering Maintenance Regulations, Alcohol and Other Drugs and Ageing Aircraft. Access is through CASA using the link:

http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_91314

Internet Resources

Extensive online resources are available and a brief selection is provided below. Students are encouraged to share web-based resources that they are aware of or that they discover during the course.

- Civil Aviation Safety Authority (Australia): <http://www.casa.gov.au/>
- Federal Aviation Administration (USA): <http://www.faa.gov/>
- Flight Safety Foundation: <http://flightsafety.org/>
- The Australian Transport Safety Bureau: www.atsb.gov.au
- National Transportation Safety Board (USA): <http://www.ntsb.gov/>
- Skybrary's Airworthines portal: <http://www.skybrary.aero/>

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 will be made to the course based in part on such feedback.

Administrative Matters

Students should be familiar with the information contained in <https://my.unsw.edu.au> regarding expectation of students, enrolment, fees and other policies that affect you. Also students must be familiar with the information provided in the Postgraduate Aviation Student Guide. This essential document can be obtained from the School of Aviation and is available on UNSW Moodle. Please contact Jamie Lim at aviam@unsw.edu.au for any administrative enquiries.