Course Outline Syllabus

BAINES | SIMMONS
World Leaders in Aviation Safety

1. Course title: Safety Assessment for Aircraft Systems

1.1 Course Introduction

This course has been designed by the author of Aircraft System Safety: Military and Civil Aeronautical Applications (Woodhead Publishing Ltd, Cambridge, 2005) and will also use material from his manuscript (to be published in 2013) entitled Aircraft Failure Assessments: A practical guide for System Safety

The course material is mature and has, since 2006, been presented to Marshall Aerospace (Cambridge), Cranfield University (UK), BAE Systems (Australia), Civilian Operators in Singapore & Hong Kong, and various air forces (e.g. SAAF, RAF and RAAF) who have needed to understand the civil approach to Aircraft System Safety Assessments.

1.2 Course learning objectives

- Introduction to Safety Assessment of Complex Systems
- Functional hazard assessment
- Probability calculations
- Reliability of systems and equipment
- Common cause failures
- Particular risks and zonal safety analysis
- Fault tree analysis
- Failure mode and effect analysis (theory/practice)
- Evaluation of in service aircraft and equipment and risk management

1.3 Course duration

- 3-days

1.4 Special Requirements of Course Participants

- An understanding of CS25 and ICAO SMS Manual (Doc 9859) would be a distinct advantage although not essential.

1.5 Special Requirements of Course

- NIL

1.6 Assessment Process

- This will be overall and continuous, against the course objectives. We also offer a multiple choice examination paper for in-house courses, at EASA's request.

1.7 Course Trainers

Primary Facilitator Mr. Duane Kritzinger

2. Technical specifications and training plan

Safety Assessment for Aircraft Systems

The regulatory framework/environment on which this course is based:

- CS25.1309
- SAE ARP4754
- ICAO SMS Manual (Doc 9859)

Outline learning objectives	Supporting documentation, materials and training aids
Outline learning objectives	
• Introduction to Safety Assessment of Complex Systems	• Modules 1.1, 1.2 and 1.3
• Functional hazard assessment	• Module 3.1
• Probability calculations	• Modules 2.1, 2.3 and 3.2
• Reliability of systems and equipment	• Module 3.2
• Common cause failures	• Module 3.4
• Particular risks and zonal safety analysis	• Modules 3.5 and 3.6
• Fault tree analysis	• Modules 2.1 and 3.3
• Failure mode and effect analysis (theory/practice)	• Module 3.7
• Evaluation of in service aircraft and equipment and risk management	• Module 1.1 and 1.3
Course introduction	
Understand course objectives and methodology; what do we want the attendee to be able to do and understand following this training course? • Course structure • Methodology • Course learning objectives/personal learning objectives	• Throughout the whole training course PowerPoint presentation and projection equipment is utilised as well as flipcharts to capture thoughts and illustrate key points. • Handouts and case study materials are passed to the attendee such that they

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can read, discuss, take notes and retain for review at a later date.

Module 1.1: Risk Management in the Safety Management System

- History & Purpose (through-life safety)
- Safety Criteria used (risk based approach)
- Safety Case Components
- SMS
- Safety Argument (in Goal Structured Notation)
- Hazard Log
- Hazards and Accidence
- Accident video and group exercise

- This module addresses, (via real world case studies) the background that led to establishment of Safety Management Systems
- Supports Ch 4, 6 & 9 of Aircraft System Safety: Military and Civil Aeronautical Applications

Module 1.2: The System Safety Assessment Process

- History & Purpose (design safety)
- Safety Criteria used (goal based approach of CS25.1309)
- Regulatory Requirements and Guidance Material
- Understanding the System Hierarchy
- Safety Strategy/Argument and benefits of Goal Structured Notation)
- Safety Assessment Procedure(from Concept to Certification)

- This module addresses, (via real world case studies) the CS25.1309 approach to Safety Assessment of Aircraft Systems
- Supports Ch 5 & 8 of Aircraft System Safety: Military and Civil Aeronautical Applications

Module 1.3: Relating the 25.1309 Criteria to the SMS Risk Criteria

- History & Purpose (design safety)
- Safety Criteria used (goal based approach of CS25.1309)
- Regulatory Requirements and Guidance Material
- Understanding the System Hierarchy
- Safety Strategy/Argument and benefits of Goal Structured Notation)
- Safety Assessment Procedure(from Concept to Certification)

- Integrates the approaches in Modules 1 & 2
- This module addresses the EASA requirement for "Evaluation of in service aircraft and equipment and risk management"

Module 2.1: Failure Probability estimation in Avionic Systems

- Apply Safety Criteria to a typical avionic modification.
- From the failure severity, deduce a safety target and show what is involved in meeting that target (via FTA case study of Primary Flight Display failure scenario)

- Demonstrates how the SSA improves/influences the design (in terms of functional performance and diagnostics)

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Module 2.2: Misleading Avionics

- Explore the safety effects of misleading instruments.
- Show how the Safety Assessment can assist in fault diagnostics and generation of Flight Reference Cards.
- Accident video and discussion
- This presentation in 5 years old, but the case study is very topical as it discusses piltotKB static failures

Module 2.3: Failure Probability estimation in Mechanical Systems

- Link structural integrity to the System Safety Assessment.
- Prove safety target accomplishment for mechanical systems (qualitative vs. quantitative).
- Maintenance philosophy vs. Safety
- Introduce "Fail Safe" Concept.
- Show how the Safety Assessment influences/relies on maintenance procedures
- Accident video and discussion
- Supports Ch 7 & 10 of Aircraft System Safety: Military and Civil Aeronautical Applications

Module 3.1: Functional Hazard Analysis

- Introduction and use of the FHA and its part in the product lifecycle.
- FHA objectives
- Simple process
- An FHA model (tailored from SAE ARP4761)
- Advantages and limitations
- Supports Ch 3 in Aircraft Failure Assessments: A practical guide for System Safety.

Module 3.2: Failure Probability Theory

- Background to quantitative probability assessment
- Symbols commonly used
- Probability Fundamentals
- MTBF and Failure Rates
- Combining Events
- Class Assignment
- System Architectures
- Class Assignment
- This module addresses the EASA requirement for “Reliability of systems and equipment”

Module 3.3: Fault Tree Analysis

- Purpose
- Notation
- Supports Ch 4 in Aircraft Failure Assessments: A practical guide for System Safety.

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- Boolean Logic
- Advantages and Limitations

Module 3.4: Common Cause Analysis

- Purpose
- Systemic vs Random failures
- Methodology (tailored from SAE ARP4761)
- Advantages and limitations

- Supports Ch 5 in Aircraft Failure Assessments: A practical guide for System Safety.
- This module addresses the EASA requirement for "Common Cause Analysis"

Module 3.5: Particular Risk Analysis

- Purpose
- Methodology (tailored from SAE ARP4761)
- Advantages and limitations

- Supports Ch 6 in Aircraft Failure Assessments: A practical guide for System Safety.
- This module addresses the EASA requirement for "Particular Risk Analysis"

Module 3.6: Zonal Safety Analysis

- Purpose
- Methodology (tailored from SAE ARP4761)
- Example
- Advantages and limitations

- Supports Ch 7 in Aircraft Failure Assessments: A practical guide for System Safety.
- This module addresses the EASA requirement for Zonal Safety Analysis

Module 3.7: FMEA, FMECA & FMES

- Purpose and distinction in FMEA, FMECA and FMES
- Safety Argument and how the FMEA relates
- Process
- Approaches at System Level 2, 3 & 4
- Example
- Advantages & Limitations

- Supports Ch87 in Aircraft Failure Assessments: A practical guide for System Safety.
- This module addresses the EASA requirement for "Failure Mode and Effect Analysis (theory/practice)"