AEROSPACE
SHORT COURSES

Introduction to Fuel Tank Safety and Ignition Prevention: Design, Certification and Compliance (AERO0361)

Instructor: Darren L. Stout, C. Bruce Stephens *(This course may be taught by either instructor).*

Course Description

This course provides details on all elements of fuel tank design needed for compliance with the regulation, with specific emphasis on electrical design aspects. Some review of regulatory history, 14 CFR 25.981 [25-102] and 25.954 are included for reference as well as TCA, STC work. Specific design implementations are examined and evaluated. The course will also include a high-level overview of electromagnetic effects and compatibility (EME/EMC), lightning effects (direct and indirect), high intensity radiated fields (HIRF), precipitation static (P-static), electrical bonding requirements, and requirements for electrical wiring interconnection system (EWIS).

Who Should Attend?

This course is designed for all design engineering disciplines, project managers, project engineers and laboratory personnel whose aircraft system may require protection of the airplane's fuel system from ignition/explosion.

Course Highlights

- The electromagnetic environment: considerations for 25.981 and 25.954
- Metallic and composite aircraft structures: considerations for 25.981 and 25.954
- The history of fuel tank protection requirements for aircraft certification
- Direct and indirect effects of lightning and HIRF testing for 25.981, 25.954 compliance
- Requirements for in-tank mounted equipment (including FQIS)
- Requirements for out-of-tank mounted FQIS
- Requirements for fuel control equipment mounted out-of-tank
- Fuel tank bonding and continued safety
- 25.981 ICA; critical design configuration control limitations

Learning Objectives

- FAA certification process and requirements
- Direct effects of lightning zoning and criticalities
- RTCA/DO-160 levels for direct effects testing
- Indirect effects of lightning
- RTCA/DO-160 levels for indirect bench testing

Course Outline

Day One

Purpose and overview

- General/definitions
- Regulatory environment

Background and regulatory actions

- 25.981 [25-16] “Fuel Tank Temperature” – 1967-2001
- TWA 800/SFAR 88
- 25.981 [25-102] “Fuel Tank Ignition Prevention” – 2001-2008
- 25.981 [25-125] “Fuel Tank Explosion Prevention” – 2008
- 24 CFR26/Lessons learned

Electromagnetic Effects and Electromagnetic Compatibility (EME/EMC)
The HIRF environment
Electrical bonding
Electrostatic Discharge (ESD)
Prescription Static (P-STATIC)
FAA certification process and requirements
25.981 team workshop

Day Two

Compliance considerations

- FQIS
- EWIS
- COS / ICA / CDCCL
- AC25-981
- AC120-97A

Design implementations

- Establish design requirements with the following considerations
- Temperature threat and design mitigations – heat sources
- Auto ignition temperature and margin
- Consideration of latent failure(s)
- Temperature of fuel tank wall
- Temperature of components within the fuel tank
- Temperature of components adjacent to the fuel tank

25.981 team workshop

Day Three

Fuel Tank Construction

- Fuel and Sealing
- Bonding

Electrical (Spark) threat

- Consideration of Latent Failure

- Ground Return Fault
- Connections Fault
- Wire harness runs internal and external

Lightning Threat and Design Mitigations

- Consideration of latent failure
- Lightning flashover
- Lightning transients
- E-field streamers and vents
- 25.981 team workshop

Day Four

Compliance implementation

- 14 CFR 25.981, Amendment 102/125
- Aircraft wiring and shielding
- Bonding
- Electrical Wiring Interconnect System (EWIS)

Verification and validation

- V&V methods
- Validate requirements as established in compliance plan are correct
- Verify design requirements established in implementation have been met
- 25.981 team workshop

Day Five

- Teams will prepare final 14 CFR 25.981 report-out
- Teams will report on their simulated compliance models and provide examples of appropriate compliance statements for FAA/EASA including design review, testing, analysis, and compliance inspections of the fuels system's type design
- ICA/COS (keeping the initial design compliant)
- EWIS and product changes
- Final Q&A/test

Classroom hours / CEUs

31.50 classroom hours
3.15 CEUs

Certificate Track

Aerospace Compliance
Aircraft Maintenance and Safety
Electromagnetic Effects
Electrical Wiring Interconnection System (EWIS)

Course Fees

Early registration course fee: $2,595 if you register and pay by the early registration deadline (45 days out).

Regular registration course fee: $2,795 if you register and pay after the early registration deadline.

U.S. Federal Employee Discount
This course is available to U.S. federal employees at 10% off the registration fee. To receive the federal employee discount, you must enter the code **FGVT116** during the checkout process. Please note that you must validate your eligibility to receive this discount by entering your U.S. government email address (ending in .gov or .mil) when creating your online registration profile. This discount is available for both the early registration and regular registration fees.

Instructor Bios

Darren Stout is an EME/HIRF/Lightning ODA UM/AR at the Boeing Company. Darren has a wealth of experience in Electromagnetic Effects (EME), High Intensity Radiated Fields (HIRF), lightning effects, p-static effects, and transmitting personal electronic devices, RTCA/DO-160, MIL-STD-461, along with extensive experience in laboratory and aircraft testing. His experience is a result of over 30 combined years as an Electrical and EME engineer with Boeing, Lucent Technologies (Bell Labs), FAA, and BancTec. He also served six years in the United States Air Force as a B-52 navigator, instructor navigator, and radar navigator (bombardier), directing and performing higher headquarters missions including aircraft, systems, and munitions testing, and is a Desert Storm veteran. He has a BSEE degree in electrical engineering (lasers, fiber optics, and antenna arrays) from the University of Michigan - Ann Arbor, is an iNARTE certified EMC Engineer, and is a Level 2 Certified TEMPEST Professional.

C. Bruce Stephens is an FAA DER/EUM in the areas of EME, HIRF, Lightning, Fuel Systems, Structures and EWIS. His aircraft certification experience includes Beechcraft Starship, King Air, Bonanza, Baron, Hawker 4000, Hawker 800XP, Premier 1, JPATS, Learjet Model 45/75, Cessna Citation Latitude, and military projects related to Boeing 707, 737, 747, 767 KC-46A Tanker, and 777. Stephens continues to work on Part 27 and 29 rotorcrafts (MH139 Grey Wolf), and space vehicle certification projects. He has assisted several smaller companies with FAA EME certification projects and is interested in the certification requirements related to new EVOL Aircraft. Stephens enjoys mentoring new FAA delegates and instructing several courses he has developed for The University of Kansas Aerospace Short Course program. These courses include HIRF, Lightning, EWIS, EZAP, DO-160, Fuel Systems, Introduction to EME, and EME Aircraft Testing/Certification. Stephens has been a Six-Sigma/Lean Master Black Belt consultant with experience in both aircraft and copper mining process improvement. He has instructed over 25 college courses, most being MBA level, including MBA Statistics, MBA Business Management, MBA Operations Management, MBA Six Sigma/Lean Production Management, Supply Chain Management, Six Sigma/Lean Black Belt and Green Belt. Universities Stephens has instructed at include Webster University, Friends University, Embry Riddle University, Southwestern College,

Newman University and The University of Phoenix. He has an executive M.B.A. and M.S. in Management from Friends University and a B.S. in Industrial Technology from Wichita State University.

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