AEROSPACE
SHORT COURSES

Aircraft Structural Loads: Criteria, Analysis, and Validation - ONLINE (AERO0655)

Instructors: Josh Sementi

Course Description

This course provides an overview of aircraft structural external loads analysis including: criteria, design, analysis, fatigue, certification, validation, and testing. It covers CFR Part 25 airplane load requirements and the historical CFR Part 23 requirements which are the basis of the current ASTM standards. These concepts are applicable to many military structural requirements, UAV's, and other experimental or novel configuration aircraft.

Course Highlights

- Overview of data requirements—aerodynamics, mass properties, stiffness, control systems and propulsion
- Certification requirements—methods of compliance and 14 CFR Part 25 and ASTM/Historical 14 CFR Part 23 loads requirements
- Structural design airspeeds derivations—construct flight envelope
- V-n diagrams—calculation of maneuvering load factors, gust load factors, construct V-n diagrams
- Maneuver loads—balanced maneuvers, abrupt pitch maneuvers, roll maneuvers, yaw maneuvers and engine-out maneuvers
- Gust loads—gust formula, discrete tuned 1-cos gust, PSD gust, vertical, lateral and head-on gust
- Ground loads—landing, taxi, ground handling, static and dynamic loads and landing gear drop test
- Airframe loads—wing, horizontal tail, vertical tail, fuselage, control surfaces and flaps
- Fatigue loads—certification requirements, fatigue missions, exceedance curve, gust and maneuver fatigue loads
- Failure Condition Loads – Oscillatory control failure, Windmilling
- Loads testing – flight loads validation, ground calibration, static limit and ultimate test and fatigue loads test

Who Should Attend?

This course is designed for practicing engineers and engineering managers whose responsibilities include aircraft Structures and Loads, either developing Loads, as a recipient of Loads data, or providing input data for Loads analysis.

Learning Objectives

- Knowledge of 14 CFR Part 25 and CS25, CFR Part 23 loads requirements and some military requirements
- How the structural loads are developed
- How the loads group interacts with other groups
- The various types of loads conditions-flight maneuvers, gust conditions, landing, ground handling, fatigue
- The flight and ground testing requirements

Course Outline

- Introduction and overview of the course
- Basic aerodynamics overview
- Certification requirements (FAR 23, FAR 25, EASA, MIL-SPECS)
- Mass properties calculations (design weights, weight-c.g. envelope development, weight-c.g. code, mass distribution code)
- Structural design airspeeds derivations (maneuver, gust penetration, cruise, dive, flap extended, design-airspeeds code)
- V-n diagrams (maneuver and gust load factors calculations, V-n diagram code)
- Introduction to external loads (definitions, static vs. dynamic, flutter, loads classifications)
- Steady maneuvers (wind-up turn, pull-up, balancing tail loads derivations)
- Pitch maneuvers analysis (abrupt pitch up, abrupt pitch down, checked pitch)
- Roll maneuver analysis
- Wing loads analysis (design wing conditions, aerodynamic distributions and interactions)
- Yaw maneuver and engine out analysis
- Horizontal tail loads analysis (HT loads certification requirements, design HT conditions)
- Vertical tail loads analysis (VT loads certification requirements, design VT conditions)
- Landing loads analysis (one wheel, two wheel, three wheel, and dynamic landings)
- Ground handling maneuver loads analysis (taxi, ground turn, nose-wheel yaw, braking, towing, jacking, ground-loads code)
- Fuselage loads analysis (inertia loads, air loads, 1g shear curve)
- Control surface and high-lift devices loads analysis (cert requirements, primary and secondary surfaces, flaps, spoilers, hinge moments, air load distributions)
- Basic structural dynamics overview and Static and dynamic gust analysis (gust load factor formula, tuned discrete 1-cos gust, PSD gust)
- Rapid Decompression analysis for Structures
- Fatigue loads analysis (normal operational conditions, missions, load spectra)
- Flight loads validation (ground loads calibration, in-flight loads measurements)
- Interaction of Systems and Structures as it affects External Loads
- Windmilling and Fan Blade Out Loads
- Static and fatigue test loads
- Safety Factors, Assumptions and Conservatism
- Course summary and wrap-up

Classroom hours / CEUs
35.00 classroom hours
3.5 CEUs

Certificate Track
This course is not part of a certificate track.

Course Fees
Early registration course fee: $2,195 if you register and pay by the early registration deadline (45 days out).

Regular registration course fee: $2,395 if you register and pay after the early registration deadline.

Course Materials
Course materials, including outlines, presentation copies, and supplementary materials, will be accessible through Canvas, KU's online learning system. Instructions to access Canvas will be provided upon completed registration.

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 Bio
Dr. Josh Sementi has 20 years of applied aeroelasticity and aircraft loads experience including both analysis and testing on Part 23 and 25 aircraft. Josh is also an FAA Consultant Loads DER with full approval authority for both Part 23 and Part 25 Static and Dynamic Loads. This experience has included developing aerodynamic models, structural models, and aero-structural splines for certification loads and flutter analysis as well as validating the models against flight loads survey and flight flutter testing measurements. This analysis has been performed in a variety of tools from classical beam theory methods to complete aircraft FEM based aeroelastic models. During his career Dr. Sementi has developed certification dynamic and static flight loads for over 25 STC's or STC amendments ranging from radomes and other minor modifications to blended and split scimitar winglets on a variety of Boeing aircraft. In addition to Structural Loads, Josh has extensive flight flutter test experience, as well as aircraft vibration environment development. Prior to working at TLG, Josh was a Senior Loads Engineer at Aviation Partners Boeing.

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CONTACT US:

KU Jayhawk Global
Aerospace Short Course Program
1515 St. Andrews Dr.
Lawrence, KS 66047
Email: jayhawkglobal@ku.edu
Phone: 785-864-6779 (Registration)