Aircraft Structural Loads: Requirements, Analysis, Testing and Certification (AERO0090)

Instructor: Wally Johnson

Course Highlights
- Overview of data requirements—aerodynamics, mass properties, stiffness, control systems and propulsion
- Certification requirements—methods of compliance and FAR23 and FAR25 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, mission requirement, exceedance curve, gust and maneuver fatigue loads
- Loads testing – flight loads validation, ground calibration, static limit and ultimate test and fatigue loads test
- Loads calculations using BASICLOADS software throughout the course

Course Description
This course provides an overview of aircraft structural external loads analysis including: criteria, design, analysis, fatigue, certification, validation and testing. It covers FAR 23 and FAR 25 airplane load requirements. However, the concepts may be applicable for military structural requirements. Loads calculation examples using BASICLOADS software will be demonstrated throughout the course week. A copy of BASICLOADS software will be provided to attendees.

Who Should Attend?
This course is designed for practicing engineers and engineering managers whose responsibilities include aircraft structures.
Learning Objectives

- Knowledge of FAR23, FAR25 and CS25 loads requirements and some military requirements
- How the structural loads are developed
- How the loads group interacts with other groups
- How to calculate basic loads
- The various types of loads conditions—flight maneuvers, gust conditions, landing, ground handling, fatigue
- The flight and ground testing requirements

Course Outline

Day One
- 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)

Day Two
- Introduction to external loads (definitions, static vs. dynamic, flutter, loads classifications)
- Steady maneuvers (wind-up turn, pull-up, balancing tail loads derivations, bal-maneuver code)
- Pitch maneuvers analysis (abrupt pitch up, abrupt pitch down, checked pitch)
- Roll maneuver analysis

Day Three
- Yaw maneuver and engine out analysis
- Basic structural dynamics overview
- Static and dynamic gust analysis (gust load factor formula, tuned discrete 1-cos gust, PSD gust)
- Landing loads analysis (one wheel, two wheel, three wheel, landing code)
- Ground handling maneuver loads analysis (taxi, ground turn, nose-wheel yaw, braking, towing, jacking, ground-loads code)
- Fatigue loads analysis (normal operational conditions, missions, load spectra)

Day Four
- Wing loads analysis (design wing conditions, wing-load code)
- Horizontal tail loads analysis (HT loads certification requirements, design HT conditions)
- Vertical tail loads analysis (VT loads certification requirements, design VT conditions)
- Fuselage loads analysis (inertia loads, airloads, 1g shear curve, fuselage-loads code)
- Control surface and high-lift devices loads analysis (cert requirements, primary and secondary surfaces, flaps, spoilers, hinge moments, airload distributions)

**Day Five**
- Static and fatigue test loads
- Flight loads validation (ground loads calibration, in-flight loads measurements)
- Course summary and wrap-up

**Classroom hours / CEUs**
31.50 classroom hours
3.150 CEUs

**Certificate Tracks**
Aerospace Compliance, Aircraft Design, Aircraft Structures

**Course Fees**
Early registration course fee: $2,495 if you register and pay by the early registration deadline (45 days out).

Regular registration course fee: $2,695 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.

**Canada Department of National Defence Discount**
This course is available to Canada DND employees at 10% off the registration fee. Please contact the DND Procurement Authority (DAP 2-3) for details. Please note that you cannot register using our online system when requesting this discount. This discount is available for both the early registration and regular registration fees.

**Netherlands Defence Academy Discount**
This course is available to Netherlands Defence Academy employees at a discounted registration fee. Please contact the NDA Procurement and Contracting department for details. Please note that you cannot register using our online system when requesting this discount.
This class is available for delivery at your company.
Your company can realize substantial savings by bringing an aerospace short course to your workplace. On-site delivery is ideal for organizations that need to train 10 or more employees on a specific topic. For more information on on-site course delivery, or to request a cost proposal, please contact us at 913-897-8782, or email us at ProfessionalPrograms@ku.edu.

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