AEROSPACE
SHORT COURSES

Flight Test Principles and Practices (AERO0290)

Instructors: George Cusimano and Greg Lewis

Course Description

This course provides an introduction to and definition of the basic flight test process, application of engineering principles to flight tests and description of common flight test practices, along with an introduction to the flight test discipline. The course is embellished with a variety of examples from completed flight test programs.

Learning Objectives

This course is intended to clarify and explain basic philosophies and principles underpinning the flight test community and its role in developing manned aircraft and their systems.

- Appreciate the historical context of why flight tests are needed and how the discipline has evolved.
- Establish the environment (the atmosphere, types of measurements, and summarize typical maneuvers used) for collecting and analyzing flight test data.
- Understand the working relationship between flight test and the system engineering community in developing aircraft and aircraft systems, especially the fundamentals of test planning and verification issues.
- Grasp the fundamentals of data recording and processing both digital and analog data from flight tests.
- Obtain an appreciation for flight test techniques covering all aspects of aircraft performance and aircraft stability and control.
- Gain exposure to selected advanced topics germane to specialized data collections (structural flight test, propulsion flight tests, stall, testing, and high angle of attack tests).
- Understand the importance of modeling and simulation support of flight tests and specific types of ground tests conducted in support of flight test.
- Grasp the fundamental nature of risk management in flight test.

Who Should Attend?

The course is designed for all levels of engineers and managers in industry working on flight test projects, military and civil project engineers, test pilots and flight test engineers, government research laboratory personnel and FAA and other regulatory agency engineers. It is ideally suited for engineers and managers from other disciplines who are moving into the flight test discipline for the first time or who must interact with flight test engineers regularly on a given project.

Course Highlights

- Flight test introduction/overview and brief history
- The standard atmosphere
- Mass, center of gravity and moment of inertia determination
- Time/space position measurements
- Air data systems
- Instrumentation system principles
- Data acquisition and processing methods
- Proper use of digital bus data
- In-flight measurement of thrust and power
- Stalls
- Flight test planning and interaction with program planning
- Preliminary preparation: modeling and simulation preparation, and value of ground testing
- Takeoff and landing performance
- Cruise performance
- Non-stabilized Performance
- Stability and control
- Structural Flight Test – Loads and Flutter
- Local Flow Aerodynamics
- Post stall testing
- Closed Loop Handling Qualities
- Safety in Flight Test

Course Outline

Day One

- Flight test overview and introduction
- The standard atmosphere: the need, derivation, and usage
- Properties, altimetry, pneumatic systems; air data principles and measurements
- Mass, center of gravity and moment of inertia determination
- Air data systems: measurement, calibration and required accuracy of airspeed, altitude, Mach number, temperature, and flow direction

Day Two

- Time/space position measurements
- Instrumentation system principles: design requirements, static and dynamic response, calibration
- Data acquisition and processing methods: analog, digital, filtering and signal conditioning
- Propulsion system testing: piston, turboprop and turbofan engines
- In-flight measurement of thrust and power

Day Three

- Stalls: theory, regulatory definitions, factors affecting stall speed and characteristics, requirements, and flight test methods
- Takeoff and landing performance
- Flight test program planning: organization, milestones, flight cards, documentation, procedures, safety issues

Day Four

- Cruise performance: speed, range and endurance
- Nonstabilized performance methods including climb, acceleration, turn, and descent performance, including transonic dynamic derivation of drag polars
- Stability and control: static and dynamic stability modes, flight tests and regulatory requirements plus methods for determining control power coefficients for flight control modeling
- Closed Loop Handling Qualities: overview of components of the closed loop, standard criteria for elements in the loop, causes of pilot-induced-oscillations, flight test methods, pilot rating scales and certification requirements

Day Five

- Structural flight tests: static loads, flutter
- Local Flow Aerodynamics: causes of shortfalls in performance and degradations of flying qualities due to unanticipated local flow anomalies, methods for determining and visualizing aerodynamic flow and flight test methods for evaluating modifications
- Post-Stall: departure from controlled flight, post-stall gyrations, deep stalls and spins, including certification tests and requirements as well as recovery systems
- Safety in Flight Test: reducing risk with mitigations while maintaining technical merit and the use of test hazard analyses

Classroom hours / CEUs

35.00 classroom hours
3.5 CEUs

Certificate Track

Flight Tests and Aircraft Performance

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.

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. Students are required to bring a computer or other electronic device with PDF-viewing capabilities with them to class each day. If you require accommodation contact us at professionalprograms@ku.edu and we will work with you on an accessible solution.

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.

Instructor Bios
George Cusimano is the co-founder and Chief Operating Officer of Vector LLC aviation consulting services. He is a flight test engineer and educator with more than 40 years of experience in research, development, and test of important leading edge technologies. He has flight-tested complex systems, such as the F-117, B-2, X-33 (single stage to orbit prototype), DarkStar UAV and X-35 (Joint Strike Fighter prototype). In addition to multiple postings as a flight test engineer, George was: the Director of Test and Evaluation for the F-117 System Program Office; the Chief of Flight Test Engineering for the B-2 Combined Test Force; the Deputy Director of the Joint STARS Combined Test Force; and the Director of Flight Test at the Lockheed Martin Skunk Works. George has also taught at the National Test Pilot School and has served as a Technical Advisor to the United States Air Force. He retired from the United States Air Force as a colonel after 24 years of service. George holds a B.S. in mechanical engineering and an M.S. in industrial engineering from Arizona State University. He is a graduate of the USAF Test Pilot School and a Fellow of the Society of Flight Test Engineers.

Greg Lewis is an aeronautical engineer and test pilot with 46 years of experience in flight testing of both military and civil aircraft. He retired from the United States Air Force after 20 years, serving initially as a fighter pilot in F-4's, including a combat tour in Southeast Asia (SEA). After returning from SEA, Greg spent the rest of his military career in flight test of fighter aircraft, including the F-4, the F-16 and a research version of the F-15, implementing thrust vectoring and inflight reversing. After leaving the Air Force, Greg joined the National Test Pilot School (NTPS), teaching academics as well as serving as a flight instructor in aircraft ranging from gliders to supersonic aircraft. In addition to instructing, Greg served in leadership

positions, including Chief Flight Test Instructor, Chief of Academics and Head of Training. Greg also is an FAA Designated Engineering Representative (DER), flight testing new and modified civilian aircraft for certification. Over his career, he accumulated over 10,000 hrs in 126 different aircraft. Greg holds a B.S. and M.S in aero/astro engineering from MIT. He is a graduate of the USAF Test Pilot School and a Fellow and Past-President of the Society of Experimental Test Pilots.

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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)