AEROSPACE
SHORT COURSES

Flight Test Principles and Practices – ONLINE (AERO0295)

Instructors: David Kern, Robert Rowe, Christopher Maston (This course may be taught by any of these instructors).

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

- 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
- 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

- 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
- 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
- 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: $2,495 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.

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.

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

David Kern is a graduate of the U.S. Air Force Test Pilot School, with experience planning and flying hundreds of flight test missions for civil aircraft certification and military projects. He is an Associate Fellow, Society of Experimental Test Pilots and Member, Society of Flight Test Engineers. He was USAF F-16 project test pilot for the Collier Trophy-winning Automatic Ground Collision Avoidance System (AGCAS) and served as USAF Test Pilot School's director of operations, teaching all parts of the multi-engine and fighter curricula. In civil flight test, he was a flight test pilot for the Aircraft Certification Service with the Federal Aviation Administration, and is currently a flight test captain for a major airline. He holds a Master of Science in Flight Test Engineering and B.Sci. Electrical Engineering with a minor in Mathematics. He is an airline transport pilot with nine type ratings, a Certified Flight Instructor for instrument conditions, and has logged piloting time at the controls of over 80 different aircraft. His publications include "Flight Test Techniques for Active Electronically Scanned Array (AESA) Radar," "Accelerated Development of Flight Tested Sensors and Systems," and "Introduction to Fly-by-Wire Flight Control Systems: The professional pilot's guide to understanding modern aircraft controls."

Rob Rowe is an aero/propulsion engineer and test pilot with 36 years of experience in flight testing of both military and civil aircraft. He retired from the USAF after 27 years, instructing/evaluating/testing in the A/T-37, B-52, and U-2 aircraft. He was a flight test engineer in the C-17, then spent the rest of his military career as a reservist at the 412th Test Wing as Operations Group Commander. He has vast experience as a Flight Test Safety officer in the 412th TW, Lockheed Martin (LM), Northrop Grumman, and NASA. Rob was hired by LM to be the chief pilot for U-2S flight test and eventually the X-55 aircraft, accomplishing first flights on both. The re-writing of the U-2 aircraft involved avionics, propulsion, air data/autopilot, glass cockpit, electrical and emergency start systems as well as evolved mission systems. The X-55 was a one-of-a-kind materials aircraft with rigorous performance and handling quality evals for FAA certification. With several "type" ratings, he's been caught teaching academics and flight

instruction in Cessnas as well as B-52s. Besides multiple Chief Pilot positions, Rob became a FAA Certified Flight Instructor (CFI), CFII, and MEI. Over his career, he accumulated over 10,000 hrs in 114 different aircraft. Rob holds a BSE from USAF Academy, a MSE (under a Guggenheim) in propulsion and control from Princeton University, and MBA from the University of LaVerne. He is a graduate of the USAF Test Pilot School and a Fellow of the Society of Experimental Test Pilots.

Christopher Maston is a seasoned technical leader with over 20 years of experience in engineering, flight test, and defense systems test and evaluation. A subject matter expert in aeronautical systems and flight test engineering, he has led high-profile defense programs and multidisciplinary teams across government, industry, and academia. Chris currently serves as a senior principal flight test engineer at MTSI and an adjunct professor at Georgia Tech, where he teaches introduction to flight test engineering. His prior roles include Technical Program Manager at GTRI and key leadership positions in the U.S. Air Force, where he commanded test teams and directed major ISR aircraft test programs. Chris holds advanced degrees in flight test and engineering management, is a graduate of the USAF Test Pilot School, and was a senior experimental test electronic warfare officer (Navigator) in the USAF. He is recognized for his contributions to modernizing flight test capabilities and advancing practical engineering education.

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