



WHITE EAGLE
AEROSPACE



Aerodynamics For Engineers

MAKE YOUR CAREER SOAR

Welcome

Thank you very much for your interest in White Eagle Aerospace. Since our founding in 2006, we have become a trusted leader in professional technical training and education throughout the aerospace industry.

As a fellow aerospace professional with over 45 years of industry experience, I understand the critical need for ongoing technical training in the workplace. White Eagle Aerospace was established in order to meet this pressing need.

For many years, we have recognized a looming crisis in the aerospace workforce. Throughout the industry, there is an increasingly bimodal distribution of aerospace professionals. One end of that distribution contains young, well trained, highly motivated, but very inexperienced professionals. The other end of that distribution involves individuals who have been around for a long time, have a great deal of experience and are on their way out of their chosen profession. This leaves a valley between the two.

Who is going to pass the baton to the upcoming generation of aerospace professionals? Where will they get their knowledge – knowledge that goes beyond academia and even graduate degrees? Much of what they need to know is not available in today's standard university curricula. What they need is:

- Specialized knowledge over a range of disciplines
- Knowledge provided by an experienced expert in the field
- Knowledge conveyed by a master instructor

White Eagle Aerospace recognizes these issues and provides effective solutions for your workforce. We are pleased to present you with this brochure, which outlines our Aerodynamics For Engineers (AFE) professional short course. Our team of industry experts and master instructors is dedicated to your success. Should you have any questions about our course catalog or desire more information on how we can help MAKE YOUR CAREER SOAR, please contact us today.

Best Regards,



John Terry White,
President/CEO
White Eagle Aerospace



About Our Company

Whether you are new to the aerospace industry or have years of professional experience, we are your provider-of-choice for expert technical training.

Acquiring key knowledge, critical lessons-learned and technical know-how are crucial ingredients for success in today's complex and highly competitive aerospace market. Our nationally-acclaimed short courses cover a wide range of highly useful technical subjects. Each course is delivered by a subject matter expert who is also an expert technical instructor.

We offer you comprehensive technical training in essential topics, with minimal time away from work – all at a price that fits today's tight training budgets.





Target Audience

The Aerodynamics For Engineers (AFE) short course provides a comprehensive training experience in basic aerodynamic principles applicable to the subsonic, transonic, supersonic and hypersonic flight regimes.

This short course is intended for the aerospace professional seeking expert instruction in basic aerodynamics principles and flow phenomena, applicable to flight ranging from subsonic to hypersonic speeds. Course material provides participants with a sound understanding of a broad spectrum of fundamental aerodynamics concepts. This knowledge and its application are essential to successful aerospace vehicle design, analysis and testing. Participants from a wide variety of aerospace related disciplines will benefit from this course.

Delivered by a master instructor and subject matter expert with over 45 years of professional aerospace experience, this 4-day intensive training course will provide participants with invaluable real-world knowledge, enhanced understanding and improved competency in this key discipline.

Who Will Benefit

- Aerodynamics Engineers
- Flight Test Engineers
- Airframe Designers
- Launch Vehicle Designers
- Aircraft Systems Engineers
- Missile Systems Engineers
- Aircraft Flight Crew
- Operations Research Analysts
- Flight Control Specialists
- Stability and Control Specialists
- Systems Engineers
- Program Managers
- College Instructors
- College Students

Group Discounts

White Eagle Aerospace is dedicated to meeting your organization's professional training needs. In order to better serve you, we offer special group discounts rates and on-site training. If you have a group of 15 or more participants, we will bring our nationally acclaimed AFE short course to your location at a discounted rate. Please contact us today to learn how we can help MAKE YOUR ORGANIZATION SOAR!





Course Description

The Aerodynamics For Engineers (AFE) short course provides a comprehensive training experience in fundamental aerodynamics applicable to flight ranging from subsonic to hypersonic speeds. The course arms participants with a sound understanding of a broad spectrum of fundamental aerodynamics concepts and phenomena.

Subject matter ranges from low-speed, incompressible flows to high-speed flows where compressibility effects such as shock waves are important. Participants will learn how aerodynamic forces and moments are generated for any flight vehicle at any speed and any aerodynamic attitude.

Course material explores the viscous boundary layer, turbulence, and flow separation and how these phenomena critically affect airfoil lift and drag characteristics. Participants will come to understand the significance of Mach number, Reynolds number, and the principle of Dynamic Similarity and their key influences in the field of wind tunnel testing.

Participants will learn the basics of aerodynamic heating and why thermal effects drive the design of high-speed flight vehicles such as aircraft, missiles and entry vehicles. They will gain a basic knowledge of aircraft and missile airframe aerodynamic characteristics, stability and control and flight performance. Finally, they will also acquire simple equational tools to make first-order, real-world aero calculations.

Key Course Topics

- The Atmosphere
- Fluid Properties
- Aero Forces and Moments
- Incompressible Flow
- The Boundary Layer
- Flow Separation
- Airfoils and Wings
- Aerodynamic Lift
- Aerodynamic Drag
- Wind Tunnels
- Compressible Flow
- Conservation Laws
- Mach Number
- Shock Waves
- Expansion Waves
- Airbreathing Propulsion
- Aerodynamic Heating
- Reynolds Number
- Planetary Entry
- Knudsen Number
- Hydrostatic Equation
- Historical Flight Programs





Course Outline

The **Aerodynamics For Engineers (AFE)** short course is an intensive 4-day training program that provides a maximum training experience to aerospace professionals with minimum time away from work.

Aerodynamics For Engineers Module Overview

Day	Module	Lecture Title	Key Topics
1	1	Basic Aerodynamics Principles	Gases, liquids, pressure, temperature, density, specific volume, Perfect Gas Law, atmospheric properties.
	2	Incompressible Flow	Steady flow, conservation of mass, velocity, area, conservation of momentum, airspeed measurement.
2	3	Viscous Flow	Fluid viscosity, shear stress, boundary layer, laminar flow, turbulent flow, Reynolds number, flow separation.
	4	Airfoils and Wings	Lift, drag, pitching moment, sectional characteristics, lift curve slope, stall, aspect ratio, wing vortex, induced drag.
3	5	Thermodynamics Principles	Internal energy, entropy, enthalpy, specific heats, conservation of energy, isentropic flow.
	6	Compressible Flow	Compressible flow regimes, Mach number, speed of sound, shock waves, converging-diverging ducts.
	7	Supersonic Aerodynamics	Compressibility, Critical Mach number, drag divergence, wave drag, Mach angle, wing sweep effects.
4	8	Hypersonic Aerodynamics	Newtonian theory, Mach number independence, viscous interaction, Knudsen number, hypersonic aircraft.
	9	Air-Breathing Propulsion	Jet propulsion principle, military thrust, afterburner thrust, turbojet, turbofan, ramjet, scramjet engines.
	10	Atmospheric Entry	Equations of motion, altitude-velocity map, entry corridor, ballistic entry, gliding entry, aerodynamic heating.



Aerospace History

Much has transpired during the 100-plus years of powered flight. We are both the beneficiaries and stewards of the technological progress that previous generations have bequeathed to us.

However, many professionals in today's aerospace workforce have little knowledge of the key people, events and innovations that comprise the history of their own profession. While we cannot live in the past, we must learn from it if we are to be successful now and in the future. Further, like our predecessors, we must protect and preserve this legacy knowledge for succeeding generations.

It is for these reasons that White Eagle Aerospace strongly emphasizes aerospace history in its technical short courses. This is done through the mediums of special presentations, videos and field trips. The Aerodynamics For Engineers (AFE) short course features several key historical programs.

Featured Programs

- Bell XS-1
- Bell X-1A
- Bell X-2
- D-558-II Skyrocket
- F-100 Super Sabre
- F-102 Delta Dagger
- F-106 Delta Dart
- B-58 Hustler
- North American X-15
- XB-70 Valkyrie
- SR-71 Blackbird





Information at a Glance

The Aerodynamics For Engineers (AFE) short course provides a comprehensive training experience in basic aerodynamic principles applicable to the subsonic, transonic, supersonic and hypersonic flight regimes.

This intensive training program is intended for anyone seeking instruction in basic aerodynamics principles and flow phenomena, applicable to flight ranging from subsonic to hypersonic speeds. This knowledge and its application are essential to successful aerospace vehicle design, analysis and testing.

Delivered by a master instructor and subject matter expert with over 45 years of professional aerospace experience, this 4-day intensive training course will provide participants with invaluable real-world knowledge, enhanced understanding and improved competency in this key discipline.

Contact White Eagle Aerospace

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520-219-0526

Key Course Information

- **Instructor:** J. Terry White
- **Duration:** 4 instructional days; 32 instructional hours.
- **Materials:** 1) Comprehensive set of course lecture slides in bound form and 2) DVD containing course lecture slides, images, videos, reference documents and homework solutions.
- **Cost:** \$2,000 for single seat.
- **Registration:** Please visit our website to view the most current Course Calendar. To register for a scheduled course, simply complete and submit the online registration form.
- **Group Discounts:** In order to better serve your organization, we offer special group discount rates and on-site training. For information, please contact Phyllis White at pjwhite@whiteeagleaerospace.com.





J. Terry White

Aerosciences Instructor

John Terry White is president and CEO of White Eagle Aerospace. With headquarters in Oro Valley, Arizona, White Eagle Aerospace is a leading provider of engineering consulting, professional training, historical flight lectures and technical publication services to the aerospace community.

White's over 45 years of professional aerospace experience includes the NASA Space Shuttle Program, NASA X-43A Flight Project, and United States Navy STANDARD Missile Program. During his extensive career, he has served on the engineering technical staff of Rockwell International, General Dynamics Corporation, Hughes Missile Systems Company, NASA Dryden Flight Research Center and Raytheon Missile Systems.

In 2009, White completed a 2-year assignment as manager of the Aerodynamics Department in the Guidance, Navigation, and Control Center at Raytheon Missile Systems in Tucson, Arizona. In this capacity, he was responsible for all aerodynamics work performed at the world's largest tactical missile producer. White resigned from Raytheon in 2010 as an Engineering Senior Fellow in Aerodynamics.

White has authored more than 180 technical papers on a wide variety of aerospace and aerospace subjects. His teaching credentials include 15 years as an instructor in the Aerospace Engineering Department of the California State Polytechnic University, Pomona, 10 years as an instructor in the professional development program at Raytheon and 6 years developing and teaching courses at White Eagle Aerospace. Those who have taken his courses say that White brings an uncommon passion and extensive technical knowledge to the training environment.

White is particularly well known for his inspiring aerospace history lectures and presentations. These "techno-histories" are intense, fast-paced reviews of historically-significant events in United States aerospace history. He has lectured extensively on aerospace history topics at the USAF Test Pilot School, the Society of Experimental Test Pilots, the National Aeronautics and Space Administration, the American Institute of Aeronautics and Astronautics, academia, and industry. White also serves as a motivational keynote speaker for aerospace conferences, business functions, commemorative events, public service organizations, special interest groups, and private business.

Courses Offered

- **Aerodynamics for Engineers**
- **Aerospace Lessons-Learned**
- **Advanced Missile Aerodynamics**
- **Aerospace Vehicle Performance**
- **Basic Missile Aerodynamics**
- **Fundamentals of Earth Reentry**
- **Fundamentals of Gas Dynamics**
- **Fundamentals of Hypersonics**

Contact Information

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