



WHITE EAGLE  
AEROSPACE



# Fundamentals of Earth Reentry

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 nearly 40 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 Fundamentals of Earth Reentry (FER) 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 Fundamentals of Earth Reentry (FER) short course provides the basic technical knowledge needed to intelligently address the critical aspects of atmospheric entry from suborbital and orbital flight.**

This short course is designed for the aerospace professional seeking expert instruction in the basic principles, science and technology of entry into the Earth's atmosphere. Participants will learn about the aerophysics of Earth reentry including gas dynamics, aerodynamics, aeroacoustics and aerodynamic heating. Course material has direct application to the design, analysis and test of manned ballistic and lifting entry. This unique training experience equips participants with a sound working knowledge of the Earth reentry environment that will be immediately useful in a wide range of aerospace professions.

Delivered by a master instructor and subject matter expert with nearly 40 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**
- **Systems Engineers**
- **Entry Vehicle Designers**
- **Test Range Operators**
- **FAA Regulatory Personnel**
- **Space Entrepreneurs**
- **Flight Test Engineers**
- **Spaceflight Customers**
- **Commercial Space Firms**
- **Flight Crew**
- **Mission Planners**
- **Thermal Protection Systems (TPS) Engineers**
- **Program Managers**
- **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 FER 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 Fundamentals of Earth Reentry (FER) short course is designed for the aerospace professional seeking expert instruction in the basic principles, science and technology of entry into the Earth's atmosphere. Course material has direct application to the design, analysis and test of manned ballistic and lifting entry.**

This intensive training program provides participants with the essential technical knowledge needed to intelligently address the critical aspects of atmospheric entry from suborbital and orbital flight. Course material provides an in-depth study of the aerophysics of Earth reentry including gas dynamics, aerodynamics, aeroacoustics and aerodynamic heating. Participants will come to understand the key characteristics of ballistic and lifting entry trajectory modes.

Technical instruction emphasizes the effects of damping of entry vehicle dynamic motion. Particularly, participants will learn how damping is affected by the structure of the Earth's atmosphere. Additional topics include: vehicle thermal protection systems, recovery systems, range safety considerations and flight crew survivability. Technical briefings are provided for a number of significant historical entry vehicles, as well as those currently under development. These case studies provide participants with valuable insights and lessons learned that are directly applicable to job performance.

## Key Course Topics

- Gas Dynamics
- Aerodynamics
- Aerodynamic Heating
- Earth's Atmosphere
- Equations of Motion
- Entry Trajectories
- Flight Dynamics
- Aeroacoustics
- Entry Vehicles
- Bioastronautics
- Range Safety
- Recovery Systems
- Free Molecular Regime
- Chemically-Reacting Flows
- Heatshield Ablation
- Flight Simulation
- Ballistic Entry
- Lifting Entry
- Plasma Effects
- Human Tolerance Limits
- Pressure Suits
- Historical Flight Programs





# Course Outline

**The Fundamentals of Earth Reentry (FER) short course is an intensive 4-day training program that provides a maximum training experience to aerospace professionals with minimum time away from work.**

## Fundamentals of Earth Reentry Module Overview

Day	Module	Lecture Title	Key Topics
1	1	Gas Dynamics	Gas models, temperature effects, chemical reactions, continuum flow, free molecule flow.
	2	Aerodynamics	Newtonian theory, pressure methods, skin friction methods, lift and drag, rarefied flows.
2	3	Aerodynamic Heating	Stagnation heating, heat transfer modes, body shape effects, thermal protection, plasma.
	4	Aeroacoustic Phenomena	Flowfield effects, body shape effects, sound pressure level, probability density function.
	5	Earth's Atmosphere	Thermodynamic properties, winds, composition, global circulation, cloud types, turbulence, atmospheric models.
3	6	Equations of Motion	Earth-centered reference frames, axis transformations, acceleration transformation equation, flight forces.
	7	Entry Trajectories	Entry modes, ballistic entry, lifting entry, planar flight path model, altitude-velocity maps, aerodynamic heating.
	8	Flight Dynamics	Angle-of-attack oscillations, density damping, vehicle spin effects, epicyclic motion, dynamic stability, roll resonance.
4	9	Earth Reentry Vehicles	Vehicle types, suborbital flight, orbital flight, historical systems, current systems, projected systems.
	10	Apollo Entry Guidance	Lift modulation, entry corridor, guidance logic, entry targeting, backup entry control modes, historical results.
	11	Shuttle Entry Guidance	Major guidance modes, Reference Drag Acceleration Profile, ranging logic, entry control law, lateral logic.
	12	Recovery Systems	Parachutes, ballutes, lifting bodies, gliders, parafoils, propulsive systems, rotors, hybrid systems.



# 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 Fundamentals of Earth Reentry (FER) short course features several key historical programs.

## Featured Programs

- Mercury Spacecraft
- Gemini Spacecraft
- Apollo Spacecraft
- Space Shuttle Orbiter
- X-15/X-15A-2
- X-24A/X-24B
- HL-10
- M2-F3
- Dream Chaser Spaceship
- SpaceShip Two
- Dragon Capsule





# Information at a Glance

**The Fundamentals of Earth Reentry (FER) short course provides the essential technical knowledge needed to intelligently address the critical aspects of atmospheric entry from suborbital and orbital flight.**

Technical instruction emphasizes the aerophysics of Earth reentry including gas dynamics, aerodynamics, aeroacoustics and aerodynamic heating. Course material has direct application to the design, analysis and test of manned ballistic and lifting entry. Training equips participants with a sound working knowledge of the Earth reentry environment.

Delivered by a master instructor and subject matter expert with nearly 40 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

**White Eagle Aerospace**  
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[training@whiteeagleaerospace.com](mailto:training@whiteeagleaerospace.com)  
**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:** \$1,760 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](mailto: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 nearly 40 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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