



WHITE EAGLE
AEROSPACE



Basic Rocket Science

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 50 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 Basic Missile Aerodynamics (BMA) 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 a master 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 Basic Rocket Science (BRS) short course provides participants with the basic multidisciplinary how-to knowledge required to successfully design, analyze, and fly rocket-powered vehicles.

This course is intended for those involved in the entrepreneurial, educational, or advocational aspects of rocketry, but who may lack the specialized technical knowledge required in such endeavors. Course material has broad and direct application to both single stage and multi-stage rocket-powered vehicles. Further, the Basic Rocket Science course is applicable to rocket flight at any scale including model rocketry, high-power rocketry, experimental rocketry, and commercial rocketry.

Rocket-powered vehicle developers, entrepreneurs and university rocket-based flight program participants will particularly benefit from taking this novel training course.

Delivered by a master instructor and subject matter expert with over 50 years of professional aerospace experience, this 3-day technical training course will provide participants with invaluable real-world knowledge, enhanced understanding, and improved competency in this key field of endeavor.

Who Will Benefit

- Commercial Rocket Developers
- High Power Rocket Enthusiasts
- Experimental Rocketry Enthusiasts
- Model Rocket Enthusiasts
- Airframe Designers
- Sounding Rocket Technologists
- Flight Simulation Specialists
- Flight Research Analysts
- Systems Engineers
- Project Engineers
- Program Managers
- College Students
- College Faculty
- Rocket Vehicle Developers
- Launch Services Entrepreneurs

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 BMA 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 Basic Rocket Science (BRS) short course provides a practitioner-based training experience in the key principles, disciplines, technologies, and how-to protocols of suborbital rocket flight.

Participants learn about the various phases of rocket flight including launch, boost, coast, and recovery. The workings of the atmosphere and its influences on endoatmospheric rocket flight performance are examined. The principles of solid rocket propulsion are presented, and representative solid rocket motor propulsion characteristics reviewed.

Trajectory simulation based on the round Earth equations of motion is a significant topic of instruction. Key rocket vehicle aerodynamics data such as zero-lift drag characteristics and aerodynamic force and moment derivatives are examined as are methods for computing these parameters. Vehicle mass properties such as weight, center-of-gravity, and moments of inertia are discussed as well as methods for computing these quantities.

Course members also receive instruction on the static and dynamic stability requirements for each stage of a rocket-powered vehicle. Aerodynamic heating effects and methodologies are presented from the standpoints of vehicle thermal design, analysis, and survivability. Parachute recovery of rocket components is discussed as is the generation of debris dispersion footprints sometimes required for range safety clearance.

Key Course Topics

- Atmospheric Properties
- Solid Rocket Motor Propulsion
- Single Stage
- Multiple Stage
- Static Stability
- Dynamic Stability
- Aerodynamic Heating
- Mass Properties
- Stabilizing Fins
- Tangent Ogive
- Zero-Lift Drag Characteristics
- Aerodynamic Derivatives
- Launch Lugs
- Altimeters
- Trajectories
- Equations of Motion
- Atmospheric Models
- Parachutes
- Dispersion Footprints
- FAA Clearance
- Flight Simulation
- Range Safety
- Data Uncertainties
- Aero Prediction
- Onboard Video





Course Outline

Basic Rocket Science (BRS) is a top-level treatment of the principles, disciplines, technologies, and how-to protocols pertinent to designing, analyzing, and flying single stage and multi-stage rocket-powered vehicles. The knowledge provided is applicable to rocket flight at any scale including model rocketry, high-power rocketry, experimental rocketry, and commercial rocketry.

Basic Rocket Science Module Overview

Day	Module	Lecture Title	Key Topics
1	1	Rocket Vehicle Flight Operations	Launch, Boost, Coast, and Recovery. Range facilities and flight support personnel. Altimeters. Record keeping. Photo and video support.
	2	The Earth's Atmosphere	Atmospheric pressure, density, temperature, and wind variations with altitude. Atmospheric models.
	3	Airframe Design	Single and multiple stage configurations. Static and dynamic stability considerations. Nose external shapes. Stabilizing fin geometries and sizing.
2	4	Trajectories	Round earth equations of motion. Rocket vehicle flight simulation. Single and multiple stage flight performance.
	5	Propulsion	Solid rocket motor operation. Total impulse categories. Thrust-time curve data. Specific Impulse. Data uncertainties.
	6	Aerodynamics	Aerodynamic zero-lift drag characteristics. Aerodynamic force and moment derivatives. Data uncertainties.
3	7	Mass Properties	Stage weight, center-of-gravity, and moment of inertia characteristics. Data uncertainties.
	8	Aerodynamic Heating	Causes of aerodynamic heating. Vehicle stagnation point and acreage heating estimation. Maximum surface temperature and airframe thermal design.
	9	Debris Dispersion Footprints	Impact/landing dispersion estimation. Range safety. Flight clearance and altitude limitations. Effects of winds, thrust misalignments, and vehicle imperfections.



Aerospace History

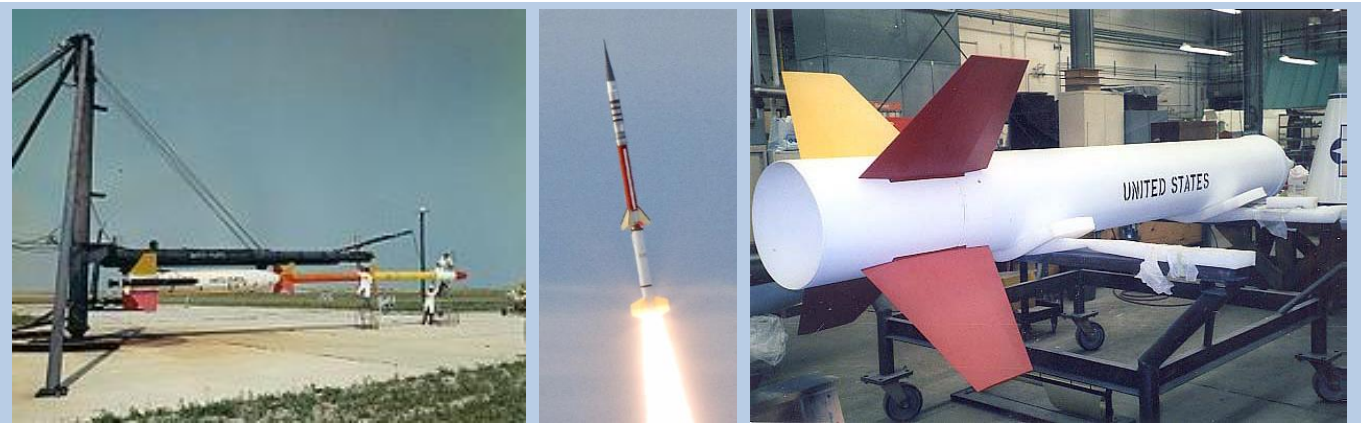
Much has transpired during the past 100-plus years of rocket-powered flight. We are both the beneficiaries and stewards of the technological progress that previous generations have bequeathed to us.

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 lecture material, videos, and photos. The Basic Rocket Science (BRS) short course features several key historical programs.

Featured Programs

- NASA Nike-Deacon
- NASA Nike-Cajun
- NASA Nike-Apache
- NASA Nike-Tomahawk
- NASA Astrobee 1500
- NASA Astrobee D
- USAF X-17
- NASA Journeyman
- NASA Trailblazer II
- NASA IRIS
- USAF ARIES





Information at a Glance

The **Basic Rocket Science (BRS)** short course provides a practitioner-based training experience in the key principles, disciplines, technologies, and how-to protocols of suborbital rocket flight. The knowledge provided is applicable to rocket flight at any scale including model rocketry, high-power rocketry, experimental rocketry, and commercial rocketry.

Essential topics covered include rocket flight operations, Earth's atmosphere, airframe design, propulsion, aerodynamics, mass properties, aerodynamic heating, trajectory simulation, and range safety debris dispersion footprints.

Delivered by a master instructor and subject matter expert with over 50 years of professional aerospace experience, this 3-day intensive training course will provide participants with invaluable real-world knowledge, enhanced understanding and improved competency in this exciting field.

Contact White Eagle Aerospace

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520-390-9157

Key Course Information

- **Instructor:** J. Terry White
- **Duration:** 3 instructional days; 24 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 50 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**
- **Basic Rocket Science**
- **Fundamentals of Earth Reentry**
- **Fundamentals of Gas Dynamics**
- **Fundamentals of Hypersonics**
- **Fundamentals of 6-DOF Aerodynamics Models**

Contact Information

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