Syllabus

ENG 105 – Introduction to Aeronautics

Aviation Challenge® Mach III

Instructors: **Dr. D. Brian Landrum,** Associate Professor, Mechanical and Aerospace Engineering
Email: david.landrum@uah.edu
Office: Technology Hall N267

USSRC Coordinator: **Sandra Kerby,** Director of Camp Operations
Director of Camp Operations, U.S. Space and Rocket Center
256-722-5633 [ph]

Course Catalog Description:

Introduction to a variety of aviation subjects, including flight physiology, computer systems, aerodynamics, aeronautics, jet propulsion, thermodynamics, navigation, and survival skills. Lectures and simulated missions. Offered in cooperation with U.S. Space and Rocket Center. Open only to high-school students enrolled in Aviation Challenge Mach III.

Requisite:

Open only to high-school students successfully completing the U.S. Space and Rocket Center Aviation Challenge Mach III.

Textbooks/ Course Materials:

Flight Log (Supplied at Aviation Challenge Camp)

Course Objectives:

After completing this course you should:

- Have an understanding of the basic principles of aviation.
- Have an understanding of the basic principles of wilderness survival.
- Have experience in coordination and communication in a team environment.
- Have hands-on experience coping with the challenges faced by fighter pilots.

Course Subject Matter:

The course is divided into the following sections:

- Aerodynamics
- Propulsion
- Flight Physiology
- Flight Simulation
- Military Logistics & Strategy
- Leadership Reaction Course
- Principles of Basic Survival

Course Grading:

A grade of satisfactory/ unsatisfactory (S/U) will be assigned for the course based on meeting the following requirements specified by the U.S. Space and Rocket Center Aviation Challenge Mach III guidelines for program completion:

- Completion of all activities to the satisfaction of the instructor.
- Attendance: Completion of the program in its entirety.
- Participation: Participation in each activity will be asked of individual based on his/her comfort level with more strenuous activities.

Students with Disabilities:

Your U.S. Space and Rocket Center Instructor should be notified of any disabilities so that appropriate accommodations can be made.

Course Outline:

Students will be divided into teams and rotate throughout the following lectures, simulations, and missions during their time at Aviation Challenge Mach III:

- **Aerodynamics**

  - **Aerodynamic Lectures:** Students will gain a clear understanding of the physics behind high performance flight. This includes the following: how Bernoulli's Principle and Newton's Laws of Motion apply to aircraft flight; what an airfoil is and its varying designs; the 4 vector forces (or 4 forces of flight); the axes along which an aircraft can maneuver; the control surfaces that allow an aircraft to maneuver; how to manipulate the control surfaces.

  - **Airport Operations:** Through presentations each student will learn proper communications and procedures when operating on the ground at an airport. Included in this will be taxi procedures, airport procedures, and terminology when speaking with air traffic control.

  - **Aeronautic Design:** This engineering challenge is focused on Aeronautics. Aeronautics is typically defined as the art or science of flight or the science of operating an aircraft. Students must design a plane using common materials provided to each team. Then the plane will compete against other sub teams. A complete grasp of the initial aerodynamics briefing will be crucial for success in this challenge.

  - **History of Air Combat and Aircraft Design:** Students learn aviation history alongside historic military aircraft. The lessons span from early flight through World War II and Vietnam eras to modern military aircraft. Students learn how and why aircraft have evolved from the first basic planes to the sophisticated military jets of today. Emphasis is given to how factors such as climate and terrain have affected engineering designs of military aircraft over the years.

- **Propulsion**

  - **Jet Propulsion:** Students will gain an understanding of the definition of jet propulsion as it relates to military aircraft. Comparing and contrasting jet engines on site at Aviation Challenge, they will learn which categories of jet engines are needed for various roles. Students will also continue their study of Newton's Laws of Motion.

- **Flight Physiology**

  - **Physiology Lecture:** Students will gain knowledge on how the human body responds in a high performance jet aircraft. Students will learn about the vestibular system, the anatomy of the human eye, and functions of the respiratory and circulatory systems in high-G flight. The Barney chair is used in the lecture to demonstrate spatial disorientation that pilots can suffer from under extreme circumstances.

  - **Centrifuge Simulator:** Students will undergo Centrifuge Training. This demonstrates the increased gravitational force (or G-Forces) felt by fighter pilots when they are training to travel at extremely high rates of speed. They will experience 3.2 G's at a seated 30° angle while completing various tasks and while focusing on communicating effectively.

- **Flight Simulations**

  - **Take-Off and Landing:** Students will learn proper take-off and landing procedures while implementing airport operation procedures that have been discussed. This will increase communication skills as well as team work.

  - **Navigational Training:** Navigational training will teach students how to use multiple radar systems, how to read and interpret a map, and how to distinguish between targets located on the ground and in the air.

  - **Air-to-Ground Training:** Navigational skills will be honed through a serious of courses that will be traversed until reaching a pre-determined target. Once at the target, each student will learn various techniques to engage their target.

  - **Top-Gun Competition:** Students knowledge and skills acquired through lecture and simulations training will be tested with the top performer(s) receiving an award.

- **Military Logistics & Strategy**

  - **Strategy:** Throughout the course students will be engaged in military training and simulations to help teach tactical strategy and logic. Students learn the basics of military plans for both on land and in flight situations. They are tested with simulated combat missions in our simulations and land survival missions.

  - **Military Drill & Ceremony and Patrolling:** Strategy and military theory are enforced by learning military drill and ceremony and how to patrol effectively as a team. Team concepts and leadership basics are at the core of the patrolling exercises.

  - **Simulated Combat Missions:** Each team will partake in a series of simulated combat missions to test all skills gained throughout the week. At the end of each test the instructor will issue a grade.

  - **Seal Ops Mission:** Each team will be tested on team work with minimal communication involving night navigation. This objective based activity will focus on nonverbal communication and key team building skills gained at the Leadership Reaction Course.

- **Leadership Reaction Course**

  - **Ropes Course:** Each team will visit the ropes facility and participate in team building activities that prepare them for the stresses of the upcoming missions. They also will experience the high elements in which they will be stretched to their limits and given the opportunity to conquer their fears.

- **Principles of Basic Survival**

  - **Land and Water Survival:** Students will gain some basic land and water survival skills. Included in this will be land navigation, food and water procurement, fire and shelter building, and water survival skills. These are skills that can aid in surviving most situations.