



## TENTH GRADE CURRICULUM

### INTRODUCTION TO FLIGHT SEMESTER ONE

In the Introduction to Flight Course, students pursuing the pilot and UAS tracks will take a closer look at the aircraft they may one day operate. Students will begin with an exploration of the types of aircraft in use today before going on to learn how aircraft are made and how they fly. Students will understand how aircraft are categorized, be able to identify their parts, and learn about aircraft construction techniques and materials. They will gain an in-depth understanding of the forces of flight—lift, weight, thrust, and drag—including how to make key calculations. They will then touch on aircraft design, looking at stability, aircraft controls, and maneuvering flight. The course will conclude with a focus on career skills related to these topics.

#### Unit 1 - Getting to Know Aircraft

Students will explore the types of aircraft operating in today's aviation environment, including traditional manned aircraft and remote piloted aircraft, or drones. They'll learn how the FAA categorizes aircraft and how to recognize aircraft of different types. Students will then investigate some of the factors affecting aircraft design, including how the aircraft will be used. This unit will give students a framework on which to build a deeper understanding of the variations in aircraft.

#### Unit 2: How Aircraft Are Made

Students will begin this unit by learning to identify the various parts of an aircraft, including the common and distinguishing features of airplanes, helicopters, unmanned aircraft, and some less common aircraft types. They will go on to look at aircraft construction with an emphasis on the materials used and the safety features of various aircraft types.



### Unit 3: Understanding Air

To understand flight, students must understand the medium in which aircraft operate. This unit will focus on the role air plays in flight, including its behavior as a fluid and the importance of air pressure. Students will also learn why the density of air is important, how it changes, and how to measure it. The concept of density altitude will be introduced.

### Unit 4: Forces of Flight

This unit takes an in-depth look into the forces affecting aircraft in motion, including the four forces of flight—lift, weight, thrust, and drag. Students will start by gaining an understanding of how aircraft move above the surface of the Earth, including how the flight path is affected by forces such as wind. They will go on to explore how lift is produced, the role of airfoil design, how to calculate lift, and the meaning and significance of an aerodynamic stall. They will also learn how to determine weight and balance for an aircraft and how faulty weight and balance affect flight characteristics. Students will examine how the power developed by an aircraft engine is converted into thrust and how various types of drag affect aircraft performance.

### Unit 5: Aircraft Stability and Control

In this unit, students will learn how aircraft are controlled and the role stability plays in aircraft performance. Students will first look at how stability, and instability, are designed into both manned and unmanned aircraft. They will also look at both primary and secondary flight controls, including control surfaces and how they are used to manage pitch, roll, and yaw.

The act of maneuvering an aircraft creates stresses that can affect the aircraft's performance and even its structural integrity. Students will learn about the types of structural loads aircraft encounter during flight as well as the role of aircraft design in determining load limits. Students will also explore how the loads placed on an aircraft affect aerodynamic stalls and how flying in rough air can affect the loads on an aircraft.



### Unit 6: Career Skills

Students will continue planning for a career in aviation and aerospace. Students will work on practical skills for presenting themselves to potential employers, including developing an elevator speech, completing a job application, and developing a resume. Students will go on to evaluate the professional, technical, and communications skills they may already have and plan a path for developing additional skills in each of these areas.

## TENTH GRADE CURRICULUM

### AIRCRAFT SYSTEMS AND PERFORMANCE

#### SEMESTER TWO

In the Aircraft Systems course, students in the UAS and Pilot tracks will take an in-depth look at the systems that make manned and unmanned aircraft work as well as the instrumentation powered by those systems. Beginning with aircraft powerplants and fuel systems, students will learn about the different options available and how they affect aircraft design and performance. They will go on to explore other key aircraft systems, including electrical, pitot-static, and vacuum systems. Throughout, they will learn about the flight instruments associated with each system and how to identify and troubleshoot common problems. This unit also covers airplane flight manuals, the pilots operating handbook, and aircraft required aircraft documents. Finally, students will learn about the factors that affect aircraft performance and how to determine critical operating data for aircraft.

### Unit 7: Aircraft Systems

Students will explore the primary systems found on most manned and unmanned aircraft. They will learn about the variety of powerplants used in manned and unmanned aircraft, including piston and turbine combustion engines and electric motors. They will learn how aircraft powerplants are classified and the fundamentals of how different types of powerplants operate. Students will learn about the variety of fuel sources used in aircraft, including JetA, avgas, diesel, and electricity. They also will learn how aircraft fuel systems are designed to accommodate each of these fuel types, the types of



instrumentation used to monitor aircraft fuel systems, and how to identify and troubleshoot fuel system issues.

In addition, students learn the basics of aircraft electricity, including how it is generated and stored. They will also examine the aircraft systems that depend on electric power, including avionics systems and unmanned aircraft systems. Lubrication, cooling landing gear and environmental control systems will also be covered.

### **Unit 8: Avionics and Flight Instruments**

In the first term, students learned about the importance of air pressure in making aircraft fly. Now they will expand their understanding of air pressure by examining pitot-static systems used to supply key information about airspeed and altitude. Students will learn how pitot-static systems are designed, how they function, the types of instrumentation they supply, and how to troubleshoot common problems.

In some aircraft, gyroscopic instruments such as heading indicators, attitude indicators, and turn coordinators may be driven by a vacuum system. Students will learn how vacuum systems function, the types of instruments they drive, and how to troubleshoot common problems.

Even in today's world of electronic navigation, the magnetic compass is an essential tool for pilots. Students will learn about the cardinal directions, principles of magnetism, errors associated with magnetic compasses in aircraft, and how to determine a flight course using a magnetic compass.

### **Unit 9: Aircraft Documentation and Manuals**

Knowledge of required documents and manuals is essential for a pilot to conduct a safe flight. In this unit, students will become familiar with required documents pertaining to aircraft ownership, airworthiness, maintenance and operations with inoperative equipment. Students will also learn how to use airplane flight manuals and pilot operating handbooks. By understanding the operations, limitations, and performance characteristics of a particular aircraft, the pilot can make educated flight decisions.



### **Unit 10: Determining Aircraft Performance**

To be able to make practical use of an aircraft and to fully understand its capabilities and limitations, students must know how to sort through an aircraft's operational data. In this unit, students will learn how to adequately plan for a mission and determine an aircraft's performance, which be affected by weight, atmospheric conditions, the runway environment, and more. Students will learn to use charts in order to determine takeoff, climb, range, endurance, descent and landing performance.

### **Unit 11: End-of-Semester Project**

A hands-on, collaborative end-of-semester project will bring together what students have learned throughout the year about the aircraft they may one day operate. They will reflect on the construction and parts of an aircraft, principles of flight, aerodynamics and forces acting on an aircraft, control and maneuvering, and systems and limitations. Students will also reflect on where they see themselves in aviation based on what they've learned throughout the year.