



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.

	No. of Sessions Per Lesson	Day of Semester
<u>Pre-Course Exam</u>	1	1
<u>Section A – Introduction</u>		
Lesson 1 You Can Fly!	1	2
<u>Section B - Categories and Classes of Aircraft</u>		
Lesson 1 Classifying Aircraft	1	3
Lesson 2 Classifying UAS	1	4
<u>Section C – Design Considerations for Aircraft</u>		
Lesson 1 Aircraft Roles and Mission	2	6
<u>Unit 1 Exam</u>	1	7
Total Sessions Unit 1	7	
Semester Total	7	

**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.

		No. of Sessions Per Lesson	Day of Semester
<u>Section A – Identifying Parts of the Aircraft</u>			
Lesson 1	Manned Aircraft Components	3	10
Lesson 2	Unmanned Aircraft Components	1	11
<u>Section B – Aircraft Construction</u>			
Lesson 1	Aircraft Structural Materials	2	13
Lesson 2	Aircraft Safety Features	2	15
Lesson 3	Unmanned Aircraft Materials	1	16
<u>Unit 2 Exam</u>		1	17
Total Sessions Unit 2	10		
Semester Total	17		

**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.

		No. of Sessions Per Lesson	Day of Semester
<u>Section A – Characteristics of Air</u>			
Lesson 1	Air is a Fluid	2	19
Lesson 2	Air Density	3	22
<u>Section B – Aeronautical Applications of Air Density</u>			
Lesson 1	Density Altitude	3	25
<u>Unit 3 Exam</u>		1	26
Total Sessions Unit 3	9		
Semester Total	26		

**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.

		No. of Sessions Per Lesson	Day of Semester
<u>Section A – The Aircraft in Motion</u>			
Lesson 1	Understanding Motion	2	28
Lesson 2	Four Forces	2	30
Lesson 3	Vectors of Flight	1	31
<u>Section B – Lift</u>			
Lesson 1	Theories of Lift	2	33
Lesson 2	Airfoils and Lift Production	2	35
Lesson 3	Calculating Lift	2	37
Lesson 4	Aerodynamic Stalls	3	40
<u>Section C - Weight</u>			
Lesson 1	Aircraft Weight and Balance	5	45
<u>Section D - Thrust</u>			
Lesson 1	In Thrust We Trust	3	48
<u>Section E - Drag</u>			
Lesson 1	What a Drag!	3	51
<u>Unit 4 Exam</u>		1	52
Total Sessions Unit 4		26	
Semester Total		52	



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 aircraft. They will also look at both primary and secondary flight controls and how they are used to manage pitch, roll, and yaw. Students will also explore flight controls for unmanned aircraft.

Students will learn how an airplane turns during flight, with an emphasis on how airplanes make coordinated turns. The act of maneuvering an aircraft creates stresses that can affect the aircraft's performance and even its structural integrity. In this unit, students will also learn about the types of structural loads aircraft encounter during flight as well as the role of aircraft design in determining load limits. Finally, they will explore how the loads placed on an aircraft affect aerodynamic stalls and how flying in rough air can affect the loads on an aircraft.

		No. of Sessions Per Lesson	Day of Semester
<u>Section A – Types of Stability</u>			
Lesson 1	Stability in Aircraft Design	3	55
Lesson 2	Rotorcraft Lift and Stability	2	57
<u>Section B – Aircraft Flight Controls</u>			
Lesson 1	Primary Flight Controls	2	59
Lesson 2	Secondary Flight Controls	1	60
Lesson 3	Flight Controls for Unmanned Aircraft	1	61
<u>Section C – Structural Loads Encountered in Flight</u>			
Lesson 1	Turns and Turning Flight	1	62
Lesson 2	Load Limits in Aircraft Design	2	64
<u>Unit 5 Exam</u>		1	65
Total Sessions Unit 5	13		
Semester Total	65		



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 learn what a career portfolio is, how it can be used to develop their career, and prepare or revise their own personalized career portfolio.

		No. of Sessions Per Lesson	Day of Semester
<u>Section A – Career Preparation</u>			
Lesson 1	Job Application Practice	1	66
Lesson 2	Resume Development	1	67
Lesson 3	Building/Revising Your Career Portfolio	2	69
Due to the nature of the content in this unit, a quiz is available, but an end-of-unit exam has not been provided.			
	<u>Post-Course Exam</u>	1	70
Total Sessions Unit 6	5		
Semester Total	70		

PROPRIETARY



TENTH GRADE CURRICULUM

AIRCRAFT SYSTEMS AND PERFORMANCE

SEMESTER TWO

In the Aircraft Systems and Performance course, students in the pilot and UAS tracks will take an in-depth look at the systems that make manned and unmanned aircraft work. Beginning with aircraft propulsion, students will learn about the different types of engines that produce thrust to propel an aircraft or UAS. They will go on to explore other key aircraft systems, including fuel, electrical, landing gear, and environmental. In order to fly an aircraft safely, students must also 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 pilot's operating handbook, and required aircraft documents. Finally, students will complete a project of designing their own airplane, and will explore the benefits of mentorship and work-based learning experiences.

Unit 7: Propulsion

To begin their exploration of primary systems found on most manned and unmanned aircraft, students will first 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.

	No. of Sessions Per Lesson	Day of Semester
<u>Pre-Course Exam</u>	1	1
<u>Section A – Pistons</u>		
Lesson 1 Reciprocating Engines	5	6
Lesson 2 Propellers	2	8
Lesson 3 The Power Cycle - Intake Systems	3	11
Lesson 4 The Power Cycle - Combustion and Exhaust	4	15
Lesson 5 Turbochargers and Superchargers	1	16
<u>Section B – Jets</u>		
Lesson 1 Turbine Engines	2	18
<u>Section C – Powering UAS</u>		
Lesson 1 UAS Engines and Fuel	2	20
<u>Unit 7 Exam</u>	1	21
Total Sessions Unit 7	21	
Semester Total	21	

**Unit 8: Airframe Systems**

The type of powerplant and the performance requirements determine the type of fuel used in an aircraft. 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. Heating, hydraulics, landing gear, environmental control systems, and anti/de-ice systems will also be covered.

		No. of Sessions Per Lesson	Day of Semester
<u>Section A – Primary Airframe Systems</u>			
Lesson 1	Fuel Systems	4	25
Lesson 2	Electrical Systems	2	27
Lesson 3	Hydraulics and Landing Gear	3	30
<u>Section B – High Altitude and Weather Systems</u>			
Lesson 1	Pressurization and Oxygen Systems	2	32
Lesson 2	Anti-Icing Systems	3	35
<u>Unit 8 Exam</u>		1	36
Total Sessions Unit 8		15	
Semester Total		36	



Unit 9: Avionics and Flight Instruments

In the first semester, 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.

		No. of Sessions Per Lesson	Day of Semester
<u>Section A – Pitot-Static System</u>			
Lesson 1	Altimeter and VSI	3	39
Lesson 2	Airspeed Indicator	2	41
Lesson 3	Pitot-Static Failures	1	42
<u>Section B – Gyros and Compasses</u>			
Lesson 1	Gyroscopic Instruments	4	46
Lesson 2	The Magnetic Compass	2	48
<u>Section C – Electronic Instruments</u>			
Lesson 1	Electronic Flight Displays	1	49
<u>Unit 9 Exam</u>		1	50
Total Sessions Unit 9	14		
Semester Total	50		

**Unit 10: Required Documentation**

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.

		No. of Sessions Per Lesson	Day of Semester
<u>Section A – Aircraft Documents</u>			
Lesson 1	AFM/POH	1	51
Lesson 2	Registration and Airworthiness Certificates	1	52
Lesson 3	Inspections	3	55
<u>Section B – Maintenance Documents</u>			
Lesson 1	Preventive Maintenance and Airworthiness Directives	1	56
<u>Section C – Pilot Responsibilities</u>			
Lesson 1	Acting as Pilot In Command	2	58
<u>Unit 10 Exam</u>		1	59
Total Sessions Unit 10		9	
Semester Total		59	



Unit 11: End of Semester Project and Career Development

The tenth grade year culminates in a review of aircraft components and design, a final project, and continued planning for a career in aviation and aerospace. Students will individually answer Private Pilot Knowledge Test questions from previous lessons to jog their memories and begin thinking about how the various aircraft components work together in particular designs to complete missions. Then they will work in pairs to create and present a poster that explains how a particular aircraft system and its components operate for different kinds of aircraft and missions. Students will then divide into teams of 3 or 4, with each team imagining it is launching a new aircraft company that will build a particular type of aircraft to serve a specific purpose or function. In the final lesson, students will explore the value of mentorships and work-based learning experiences.

		No. of Sessions Per Lesson	Day of Semester
<u>Section A – End of Semester Project</u>			
Lesson 1	Design an Airplane	7	66
<u>Section B – Growing Your Skills</u>			
Lesson 1	Mentoring	1	67
Lesson 2	Work-Based Learning Experiences	2	69
Post-Course Exam		1	70
Total Sessions Unit 11	11		
Semester Total	70		