Semester 1 – Introduction to Flight

Unit 1 – Getting to Know Aircraft

Section B – Categories and Classes of Aircraft

Lesson 1 – Classifying Aircraft

Activity 1 – Four Corners Activity

Alternate Activity – Have students conduct the research online. The teacher may wish to provide **Classifying Aircraft Teaching Aid** electronically, but students should be able to search for aircraft pictures online.

Unit 2 – How Aircraft Are Made

Section A – Identifying Parts of the Aircraft

Lesson 1 – Manned Aircraft Components

Activity 1 – Modeling an Airplane's Components

Alternate Activity – Students who have scissors, markers, tape, etc., at home may be able to complete the activity. They may then take and submit pictures with their written document.

You may wish to offer students the option of drawing a diagram of an airplane with labels for the components listed in the "Modeling an Airplane's Components" activity.

Section B – Aircraft Construction

Lesson 1 – Aircraft Structural Materials

Activity 1 – How to Build an Airplane

Alternate Activity – None needed; ensure students have the appropriate link to the video to complete activity: "How Cirrus Builds Airplanes" (Length 13:36) http://safeyoutube.net/w/zhPd (For students unable to access safe YouTube links: https://www.youtube.com/watch?v=-PdTNmPoY94).

Unit 3 – Understanding Air

Section A – Characteristics of Air

Lesson 1 – Air is a Fluid

Activity 1 – Viscosity Activity

Alternate Activity – Students can complete this activity with materials normally found at home. A cookie sheet, baking tray, or cutting board may be used for the ramp. As stated in the activity, any selection of fluids may be used in the trials.

For students unable to conduct the experiment at home, you may wish to assign this video about viscosity: "The Sci Guys: Science at Home - SE2 - EP7: Viscosity of Liquids" (Length 5:44)

https://safeYouTube.net/w/p56cb (For students unable to access safe YouTube links: https://www.youtube.com/watch?v=f6spBkVeQ4w). The video includes footage of a viscosity test similar to what is in Viscosity Activity. Additionally, the video provides instruction about viscosity.

Lesson 2 – Air Density

Activity 2 – Layering Water

Alternate Activity – This experiment can be done at home with minimal materials. As an alternative, a video demonstrating the experiment can be found at: https://safeYouTube.net/w/uB6cb (For students unable to access safe YouTube links: https://www.youtube.com/watch?v=hYFIlmOebWs).

Section B – Aeronautical Applications of Air Density

Lesson 1 – Density Altitude

Activity 4 – Flight Simulation: Experience Density Altitude

Alternate Activity – Students with at-home flight simulators can conduct this experiment without modification. Students without a flight simulator can check out the following online articles and videos to get a sense for how field elevation, temperature, and air pressure affect takeoff roll and climb performance:

How Density Altitude Caused a Plane Crash Shortly after Takeoff
https://www.boldmethod.com/learn-to-fly/performance/prevent-a-density-altitude-crash-on-takeoff/

Understanding Density Altitude: Go Beyond the Textbook Definition
https://www.aopa.org/news-and-media/all-news/2016/september/08/density-altitude

Unit 4 – Forces of Flight

Section A – The Aircraft in Motion

Lesson 1 – Understanding Motion

Understanding Motion Teaching Aid

Alternate Activity – A detailed video demonstration of the Hero Engine was created by FlinnScientific: "An Easy Hero Engine" (Length 6:25) https://safeYouTube.net/w/NP6cb (For students unable to access safe YouTube links: https://www.youtube.com/watch?v=xKKCBzD7EQs).

Section B – Lift

Lesson 1 – Theories of Lift

Activity 1 – The Great Lift Controversy

Alternate Activity – Live online classroom environments will be able to have students work in teams remotely and present their findings remotely. Asynchronous online learning environments may require alternate means of presenting students' theories of lift production. Consider asking students to record themselves making a presentation as though they were at the "conference." They may make a video of themselves speaking or narrate a set of slides. Additionally, you may offer the students the option of submitting a traditional paper explaining their position.

Activity 2 – Magic Balloons

Alternate Activity – If students have access to materials then no modification is necessary. A video of the experiment was done by Science Buddies and is available at https://www.youtube.com/watch?v=I_kIbu1kOwo.

Students may also perform a demonstration of this principle using two strips of paper. This video has a demonstration: "Bernoulli's Principle: Air Foil and Pieces of Paper" (Length 1:22) https://safeYouTube.net/w/IVIcb (For students unable to access safe YouTube links: https://www.youtube.com/watch?v=ORd2pgKbM6M).

Lesson 3 – Calculating Lift

Activity 3 – Airfoil Simulation Application

Alternate Activity – As noted earlier in the semester and in the Lesson 3 lesson plan, an online wind tunnel simulation is also available at https://www.grc.nasa.gov/www/k-12/airplane/foilsime.html. This free tool may be used in lieu of the iPad application mentioned in the lesson plan.

Activity 4 – Three Lift Scenarios

Alternate Activity – None needed, but the activity requires students to have access to a scientific calculator equivalent.

Lesson 4 – Aerodynamic Stalls

Activity 2 – Accelerated Stall Encounter and Recovery Simulation Activity

Alternate Activity – Students who do not have access to a simulator may benefit from watching the Sporty's Video Tip on accelerated stalls at https://www.youtube.com/watch?v=Mgz0DZW8Q2s.

Section C – Weight

Lesson 1 – Aircraft Weight and Balance

Activity 3 – Calculating Weight and Balance

Alternate Activity – None needed, but the activity will require a scientific calculator or equivalent.

Activity 4 – Weighty Concepts and Calculations

Alternate Activity – None needed, but the activity will require a scientific calculator or equivalent.

Activity 5 – Flying with Friends

Alternate Activity – None needed, but the activity will require a scientific calculator or equivalent.

Section D – Thrust

Lesson 1 – In Thrust We Trust

In Thrust We Trust – Aero Quiz Show

Alternate Activity – This activity can be converted into an online game of varying types. Examples include Kahoot (https://kahoot.com/) and Jeopardy Labs (https://jeopardylabs.com/build/). Game setup and execution will vary greatly based on the school's specific online learning setup. You will need to enter the words and definitions if using online tools like Kahoot or Jeopardy Labs.

Activity 1 – As the Prop Turns

Alternate Activity – This is a challenge for students who do not have access to balsa airplanes at home. Teacher may want to consider demonstrating this activity for students.

Activity 2 – Engineering a Jet Engine

Alternate Activity – The Trent XWB app is now also available for Android at https://play.google.com/store/apps/details?id=com.rollsroyce.cle.apps.trentxwbar. Students who cannot download the app can watch a video about the interior components of the XWB engine at https://www.youtube.com/watch?v=zaanOUZgzOY.

Section E – Drag

Lesson 1 – What a Drag!

Activity 1 – Drag Race

Alternate Activity – This activity is materials-intensive and is probably not within the scope of most students completing at home. You may wish to assign the following two articles which discuss landing gear and parasite drag. The first article describes the parasite drag of landing gear: https://www.flight-mechanic.com/landing-gear-types-fixed-and-retractable-landing-gear-part-one/. The second article describes the form drag of landing gear: https://www.boldmethod.com/learn-to-fly/aerodynamics/parasite-drag-and-your-airplane/.

Unit 5 – Aircraft Stability and Control

Section A – Types of Stability

Lesson 1 – Stability in Aircraft Design

Activity 2 – Aircraft Design and Stability

Alternate Activity – This activity is a partner activity. It can be completed by individual students, if necessary.

Activity 3 – Simulating Stability

Alternate Activity – Students without simulators will need an alternate activity. While it is not an experiment, the following video has some interesting animation of the types of stability examined in the simulator activity: "Static stability vs. dynamic stability" (Length 2:43): https://safeYouTube.net/w/k8Lcb (For students unable to access safe YouTube links: https://www.youtube.com/watch?v=Q2DOus05Qso).

Lesson 2 – Rotorcraft Lift and Stability

Activity 1 – Superchopper Challenge

Alternate Activity – This activity is a partner activity. It can be completed by individual students, if necessary.

Section B – Aircraft Flight Controls

Lesson 1 – Primary Flight Controls

Activity 2 – Simulating the Effects of Flight Controls

Alternate Activity – Students without simulators will need an alternate activity. While not a simulation, the following video explains the movement of control surfaces and their effect on an airplane: "Aircraft Systems - 02 - Flight Controls" (Length 6:38): https://safeYouTube.net/w/QPLcb (For students unable to access safe YouTube links: https://www.youtube.com/watch?v=WhQ8Ai4fa_Q).

Lesson 2 – Secondary Flight Controls

Activity 2 – Explore the Effects of Secondary Flight Controls

Alternate Activity – This lesson is strictly an online activity. The app is also available for Android at (https://play.google.com/store/apps/details?id=com.algorizk.windtunnel) (paid).

Section C – Structural Loads Encountered in Flight

Lesson 2 – Load Limits in Aircraft Design

Activity 1 – Simulating G-Forces

Alternate Activity – Teachers may be able to demonstrate themselves doing the experiment.

Unit 6 – Career Skills

Section A – Career Preparation

Lesson 1 – Job Application Practice

Activity 1 – Write Your Own Elevator Pitch

Alternate Activity – Writing the elevator pitch can be done as written. However, the presentation of the pitches might be challenging, depending on the nature of the technology for any given class. One option might be for students to tape themselves using their phones and uploading for peer review.

Lesson 3 – Building/Revising Your Career Portfolio

General Notes:

This lesson, as the culminating semester activity, has multiple activities, at the completion of which students are supposed to have a printed portfolio that they self-assess and have two fellow students peer-review. The activity as written has the students store their portfolio in a three-ring binder with divider tabs and document protectors for storing evidence. Access to computers, printers, and scanners is also required.

Students should have printed versions of each activity available to them.

Students will need to have access to completed activities from throughout the semester for reference.

Students will also need to find two peers to conduct reviews of their final projects.

Perhaps most importantly, students will need considerable teacher guidance on issues such as deadlines and time management to complete the project.

While the intention was to have a physical binder for the career portfolio, an electronic version is acceptable. Saving all the appropriate materials in an online space such as Google Drive allows students to organize their portfolio materials.

Assembling the portfolio documents in a fashion that allows others to view the documents and artifacts may be done using online tools that range from sharable slide decks (Google Slides, for example) to Squarespace (https://bit.ly/2ZEAWUN), Crevado (https://crevado.com/), or similar site.