

FLIPPED LESSON

AVIA 2 - VEHICLE PERFORMANCE CHART LESSON

GUIDED PRACTICE DOCUMENT

Individual Space Activity *(practice before class)*

Required Time in Individual Space: **TOTAL OF 90 MIN**

Overview:

This activity introduces you to vehicle performance: what “performance” means, where to find information about it for a specific airplane and how to compute performance in given conditions. The following basic and advanced learning outcomes are sought, and activities in this guided practice will help you master basic learning outcomes on your own. Advanced learning outcomes will be targeted in class (Note: completion of the preparation before coming to class is a fundamental pre-req to understand the in-class activities).

Basic Learning Outcomes:

1. Identify the section of the Airplane Information Manual where vehicle performance charts are included
2. Identify the takeoff performance charts in your Airplane Information Manual and differentiate them based on weight of the airplane
3. Identify variables that affect takeoff performance
4. Compare the takeoff tables to the landing tables and identify differences (if any)
5. Compute ground roll distance and 50ft obstacle clearance distance for both takeoff and landing

Advance Learning Outcomes:

1. Given a chart in either tabular or graphical form, map the chart to the specific performance of the airplane
2. Given a chart in either tabular or graphical form, identify the variables needed to use the chart
3. Given a chart in either tabular or graphical form, compute the specific performance for a given set of data, using interpolation when needed

Instructions and Checklist:

1. Carefully read this document in its entirety BEFORE DOING ANY WORK
2. Complete the following Steps 1 through 5. Each of the activities listed serve the purpose of mastering the basic learning outcomes. Upload all your work to CANVAS (make sure that the whole work is legible) by “DUE DATE” (Deadline will be about 2 days before the lecture on this topic, all the assignments are posted well in advance – min. 10 days)
3. Make sure you complete all activities by “DUE DATE”

4. Depending on class participation, the instructor may choose to grade this activity or not. Submission on CANVAS will close on "DUE DATE" 12:00 pm and no late work will be accepted in class time.

Material needed:

- Airplane Information Manual Cessna 172 (copy available on Canvas)
- Calculator
- PHAK: Pilot Handbook of Aeronautical Knowledge (copy available on Canvas)
- Paper and Pencil
- Laptop/Smartphone to watch videos

Background/Context:

We are now in week 5 of the class. We have covered the basics of aircraft subsystems and the structure of the atmosphere, with the variables that affect how an aircraft generates lift and how an engine generates thrust. Lift and Thrust capabilities and the effect of these variables are generally referred to with the general term of "performance", which is what we will cover in this lecture. Vehicle performance cover capabilities such as takeoff and landing, range and endurance, and climb and descent. Depending on the type of flight you are conducting you may wager more one performance than another one. Critical thinking has to be acquired to understand what are the major constraints for the particular mission you have to fly. In this lecture we will get each student acquainted with the performance charts used in the written knowledge test exam given by the FAA (Federal Aviation Administration).

STEP 1: Watch the proposed [10 min](#) video that introduces this activity (I will make a short video to show them the manual they are supposed to use and the definition of "vehicle performance" and give out a few examples of what is considered performance of the airplane and what is not. The video will be posted on CANVAS and I will include the path to the file here)

STEP 2:

Basic Learning Outcomes and Basic Activities: Carry through the following activities (indicated by lettered bullets –e.g., "a. b. c."). Activities are associated to the basic learning outcomes you are supposed to master on your own.

1. Identify the section of the Airplane Information Manual where vehicle performance charts are included.
 - a. Label (e.g., with a sticky notes) the following performance charts: takeoff performance, landing performance, rate of climb, cruise, range, endurance ([5 min](#))
2. Identify the takeoff performance charts in your Airplane Information Manual and differentiate them based on weight of the airplane
 - a. Count how many charts are provided for takeoff. How many are there?

- b. Explain (in written form) why there is more than one. This should not be a one-word sentence. Explain which variables differentiate the different charts and why it makes sense to have more than one. This answer should be a short paragraph of about 4-5 lines.
 - c. While planning for your next flight, your instructor tells you that you can bring with you only one of those charts. Which one would you pick and why? (This answer should be a short paragraph of about 4-5 lines).
(5 min)
 3. Identify variables that affect takeoff performance
 - a. Explain the structure of the chart identifying what rows and columns of the table represent
 - b. What happens if Pressure Altitude Increases? (*Look at how the numbers change and identify a trend. The answer should be a short sentence with the following structure "If the pressure altitude increases than takeoff distances increase/decrease. This makes sense/does not make sense because --- STATE RATIONALE"*)
 - c. What happens if Temperature Increases? (*Look at how the numbers change and identify a trend. The answer should be a short sentence with the following structure "If the pressure altitude increases than takeoff distances increase/decrease. This makes sense/does not make sense because --- STATE RATIONALE"*)
 - d. Once you are done with the previous points, or if you get stuck while trying to answer them, skim through PHAK Ch. 11 to understand the basics of performance charts
(15 min)
 4. Compare the takeoff tables to the landing table and identify differences (if any)
 - a. Why is there only one landing table?
 - b. What happens if the landing weight is lower than the one provided?
 - c. What happens if the landing weight is higher than the one provided? What do you think you should do in this case?
 - d. What variables affect landing (look at different rows and columns)?
 - e. Do you find any difference in the variables that affect landing, compared to those that affected take-off (per your answers at point "3" of this practice)
(10 min)
 5. Compute both the ground roll distance as well as total 50ft obstacle clearance distance for both takeoff and landing
 - a. Do the computation for an airplane weight of 2550 lb at 20 C at 1,000 ft
 - b. Could you takeoff and land at our airport RHV (Reid Hillview)? (Check information on RHV runway length online)
(10 min)

STEP 3: KWL – Know Want Learn Activity (10 min): fill in the first two columns of the following table and bring the completed table with you to class. We will complete the third column in class! Make sure you submit this table with your work on CANVAS by DUE DATE.

This table serves you as a way to summarize the usefulness of this “individual study space” activity. Topics that were new to you and you think you mastered (in relation to the basic learning outcomes) should go under the first column. Any doubt/question that arises while doing the activity and is not solved by the end of it should go in the second column.

| What I Know | What I W ant to learn | What I Learned |
|--|--|---|
| <p>Complete</p> <p><i>Example: I learned that there are performance charts for takeoff and landing</i></p> <p><i>I learned that pressure altitude affects performance in this or that way</i></p> <p><i>Etc.</i></p> | <p>Complete</p> <p><i>Example: I do not understand the role of temperature. Why is hot/cold better? (TRY TO BE SPECIFIC WITH YOUR QUESTIONS)</i></p> | <p>DO NOT COMPLETE (complete after lesson in class group space)</p> |

STEP 4 (optional): Post on the Classroom Blog on CANVAS your Muddiest Points (5 min). *This is an optional activity; however, you may wish to post on the Blog so that the Instructor knows about your difficulties BEFORE you come to class and can help dissolve doubts before the midterm/final.*

STEP 5: Watch the proposed end-of-activity video (10 min) (I will make a short video to introduce what other charts we will see in class and how the upcoming material will be different than what they have seen on their own. The video will also be posted on CANVAS and link/path provided here)

LESSON PLAN

Group Space Activity – AVIA 2 Vehicle Performance Lesson

Class Time: 75 min

Materials Needed:

- Airplane Information Manual Cessna 172 (available on Canvas)
- Calculator
- PHAK: Pilot Handbook of Aeronautical Knowledge (available on Canvas)
- Paper and Pencil
- Laptop/Smartphone to participate in clicker

Advanced Learning Objectives *(to be mastered during and after class):*

1. Given a chart in either tabular or graphical form, map the chart to the specific performance of the airplane.
2. Given a chart in either tabular or graphical form, identify the variables needed to use the chart.
3. Given a chart in either tabular or graphical form, compute the specific performance for given set of data, using interpolation when needed

Background/Context:

We are now in week 5 of the class. We have covered the basics of aircraft subsystems and the structure of the atmosphere, with the variables that affect how an aircraft generates lift and how an engine generates thrust. Lift and Thrust capabilities and the effect of these variables are generally referred to with the general term of "performance", which is what we will cover in this lecture. Vehicle performance cover capabilities such as takeoff and landing, range and endurance, and climb and descent. Depending on the type of flight you are conducting you may wager more one performance than another one. Critical thinking has to be acquired to understand what are the major constraints for the particular mission you have to fly. In this lecture we will get each student acquainted with the performance charts used in the written knowledge test exam given by the FAA (Federal Aviation Administration).

Planned Lesson Time:

| Activity | Related LOs | Duration |
|--|---|----------|
| Kahoot! Clicker to test knowledge and critical thinking about the pre-class activities and figure out if they did do | All basic LO identified in the study guide are applicable. This activity is meant to test | 10 min |

| | | |
|--|--|--|
| <p>the work. Possible questions (all multiple choice) would include the following:</p> <ol style="list-style-type: none"> 1. Which variables affect takeoff performance? 2. Which of the following performance charts can you find in section 5 of the Airplane Information Manual? 3. Two airplanes are taking off from the same airport. One weighs 2550 lb, the other one weighs 2800 lb. Which of the following statements is true? 4. How does pressure altitude affect landing distance? 5. How does temperature affect performance? | <p>their retention of the individual space activities.</p> <p>Also Advanced LO 1& 2</p> | |
| <p>Example problem with data not included in the provided tables → need for interpolation and how to work interpolation. Brief presentation to the board (slide with steps) and Handout to students</p> | <p>Advanced LO 3</p> <p>(need to prepare a short 1-page handout on interpolation with example)</p> | <p>15 min</p> |
| <p>Divide and Conquer exercise: students in pair will need to apply interpolation to compute range and endurance for a given airplane and loading configuration. They will need to check each other's work before submission → if mistakes are not found by the team, the total points for this activity will be subtracted from their grade instead of added.</p> <p>(Teams will be previously made by the instructor. The two students will need to solve their own portion of the problem by themselves before they are allowed to exchange the solution. However, they are supposed to plan how to solve it together in the first 5 minutes. For missing students, one 3 people team will be made with one student checking</p> | <p>Advanced LO 1, 2, and 3</p> | <p>35 min</p> <p>Time breakup: plan on how to solve the activity (5 min), each person solving his portion (20 min), checking of each other's work (10 min)</p> |

| | | |
|---|---------------------|--------|
| work from both team mates. Each team should submit one solution only) | | |
| The same exercise presented in STEP 2.5 of the individual practice will be proposed in class, but this time in a visual graph form instead of the tabular form. Students will be asked to verify that they obtained the same answer. (Photocopies of all the charts used will be provided to the students in class) | Advanced LO 1 and 2 | 10 min |
| Presentation of post-class activity | | 5 min |

Post-class Activity: estimated duration 60 min

Similar to what was done in preparation for this class, you will follow the STEPS indicated to complete your preparation.

STEP 1: Critical thinking (10 min)

In our last exercise in class, you were provided with data for a different airplane, and in a different format: graphic data instead of all tabular like in your Airplane Information Manual. Reflect and answer the following questions:

- Compare the information needed for a graphic chart of takeoff to the tabular format. Are they different? Why? (Explain the variables needed for both types and try to understand if different variables are needed/used. Motivate your answer. This should be a short paragraph of about 3-4 lines)
- What happens in a situation where interpolation is needed for the table, but you have been provided a graphic chart instead? Is interpolation still needed? How will you find the answer?

STEP 2: Homework assignment (50 min)

The HW #3 is posted on Canvas. Using what you learned in class and during your individual space time solve the 5 posted problems. (I would use my regular homework I have prepared for the course. They tend to be short and to the point. Actually now that they are covering exercises in class it might be easier for them and quicker to go through).

Analysis and Evaluation of the Entire Lesson (Pre-Lecture-Post):

Each student and the overall flipped classed experience will be evaluated with the following input documents:

PRE:

1. Check on CANVAS that the student has logged in and watched the introductory video
2. Verification of the Airplane Information Manual and the correct labeling of the performance charts
3. Grading, with feedback, of the submitted answers in regards to basic LOs for critical thinking associated to variables and choice of different performance charts per STEPS 3-5.

LECTURE:

1. The Kahoot! clicker is anonymous but will give the instructor a sense of the overall class understanding. Having gone through the pre-class activities of the students already, the instructor will be able to point out common mistakes or misconceptions student acquired during the individual space activity
2. Divide and Conquer: The course AVIA 2 has a multitude of in-class activities with associated points that sum up at the end of the course and that constitute 10% of the overall grade. The Divide and Conquer exercise is one such in-class activity worth 30 points (15 points for range and 15 points for endurance). Students can gain any grade between -30 to +30 as the policy states that they need to check each-other's work, and that negative points will be awarded for missing checks. The instructor will be assessing the checking stage by walking through the desks during the activity. The class is typically 40 students and the instructor has had success in the past in being able to scan the entire room without additional help. Actual checkmarks from each student with a different color pen will need to be included in the exercise sheet.
3. Visual charts: This exercise is not graded, as they should obtain the same solution they got from the pre-activity (the correct solution is provided anyway!).

The instructor evaluates the experience as well. The following areas are used for self-assessment of the activity:

- was the lesson completed in time?
- was the plan well balanced with regards to time and student's involvement?
- did the entire class participate actively in the clicker exercise? If not, what were the issues?
- did the entire class participate actively in the divide and conquer? Identify teams that may not have functioned properly for re-assignment

POST:

1. Critical thinking on interpolation: this is a technique that is used often throughout the course. The correct understanding is important and has to be acquired as soon as possible. Feedback will be provided for each answer of STEP 1 of the post class activity.
2. Grading of the HW as usual for the course AVIA 02. Students are provided feedback on the homework as well as grading scheme and where they lost points. If they come to office hours they have access to the solution sheet, which is NOT posted online.