

# 2018 Physics of Flight: Takeoff Flight Testing

## Class Outline and Syllabus

### Course Description

This course will use the exciting field of aerospace and flight testing as a way to enthuse students about learning math and science principles. Students will explore the physics of flight through the study of aeronautical engineering and flight test using current industry practices and an engineering grade flight simulator. They will learn the forces of flight and how an airplane flies. In teams of two, students will conduct airplane takeoff testing, varying variables such as flap setting and gross weight and then use kinematic equations to calculate runway takeoff distance comparing their results with the simulator's values. Students will prepare a presentation to give project results to Museum of Flight Docents and other aerospace industry experts.

Each class will last 90 minutes and include a presentation and a lab that will include student activities. Students from Junior High through High School are welcome as differential instruction will be utilized to keep all students engaged.

### Course Topics

Here are the following technical topics that will be covered in the class. In addition students will be taught how to use the simulator, fly an airplane, collect and analyze the data.

- Anatomy of an airplane
- Flight Instruments
- Airplane forces of flight
- Lift and the Lift equation
- Velocity
- Distance

### Duration

The course will contain approximately 12 sessions, with each session conducted on each

### Required Materials

Pencils, composition books, calculator (all provided)

### Assignments

There is no plan for any formal homework as time will be allotted in class to complete most assignments. These assignments will include worksheets to allow students to practice the lesson material, assessments to determine comprehension and journal entries at the end of each class so

the instructors can assess student understanding. In the lab portion, students will conduct airplane flight testing using the simulator, collect and analyze data, compile results and prepare a poster presentation summary of the project.

### **Common Core Standards**

Research into the Common Core Standards for math and science revealed a new series of standards adopted by Washington State recently for science called Next Generation Science Standards, NGSS. The following middle school science standard (MS-PS2-2) was addressed by the takeoff investigation of varying gross weight and flap setting to manually calculate takeoff distance and compare that with what the simulation determined. The math standard that follows (8EE.5) was demonstrated by the plotting of velocity and time, realizing that acceleration is the slope of the velocity.

*MS-PS2-2: Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.*

*8EE.5 Understand the connections between proportional relationships, lines, and linear equations. Graph proportional relationships, interpreting the unit rate as the slope of the graph.*

## 2018 Boys and Girls Club: Physics of Flight

### Takeoff Flight Testing Class Schedule

<b>Session</b>	<b>Presentation Topic</b>	<b>Activity</b>	<b>Lab Activity</b>
1	Introduction to class, syllabus etc	Intro and FT Movie	Xplane Demo
2	Anatomy of an airplane	Explore airplane parts with a balsa airplane	Set up airplane, airport
3	Flight Instruments	Instrument panels worksheet	Instrument panels
4	Forces and Airplane Forces	Build wind vane	Normal takeoff and How to fly
5	Lift and Lift Equation/Test Plans	Explore lift	Config setup and data selection
6	Anatomy of a Takeoff	Takeoff plot review	C172 Takeoff testing/analysis
7	Velocity	Velocity worksheet	Data Reduction/Re-fly
8	Distance	Distance worksheet	B777 Takeoff testing/analysis
9	Data Reduction		Data Reduction/Re-fly
10	Review	Create Presentations	Create Presentations
11	Class Summary	Assessment/Course Evaluations	Rehearse Presentations
12	Presentations		