INCORPORATING STEMPilot CURRICULUM AND FLIGHT SIMULATOR ACTIVITIES IN MATH LESSONS AND IN AEROSPACE-THEMED CLASSES

Notes:
1. Before doing math or science lessons with flight simulators, first fly Missions 1 through 3 to give students a basic concept of flight
2. The following math and science lessons are just a sampling of those that are possible; teachers can develop many more lessons on additional topics

Using Edustation Flight Simulators in Math Lessons:

Math Lesson	Complementary Flight Simulator Activity	Sample of Common Core Math Standards Met by Activity
Measurement (inquiry lesson)	Opening: Look at the airplane's instrument panel – what do you see? Learning Target: I can fly the flight simulator profile and measure several variables. Main activity: Students discuss what they think they can measure and what the units will be; students fly the flight simulator while non-flying group members measure different variables of their choice; students explain how they are measuring and what the variables mean; students present their results to the class and discuss them; (consider optional follow on lesson on units of measure).	5.MD.A.1 5.MD.B.2 HSN-Q.A.1 HSN-Q.A.2 HSN-Q.A.3
Rate of change (inquiry lesson)	Opening: What are some rates of change that occur as an airplane flies? Learning Target: I can fly the flight simulator profile and measure several rates of change. Main activity: Students discuss what they think they can measure and what the units will be; students fly the flight simulator while non-flying group members measure different variables of their choice while also measuring the time; students explain how they are measuring and what the variables mean; students calculate the rates of change they measured; students present their results to the class and discuss them.	8.EE.B.5 8.EE.B.6 8.F.B.4 8.F.B.5
Arithmetic series	Opening: If an airplane is traveling at a constant speed of 120 MPH, how far would it go in 1 hour? 2 hours? How do we know this? Learning Target: I can fly the flight simulator profile and see how a constant rate results in an arithmetic series. Main activity: Students discuss rate and constant rate; students take off in the flight simulator, climb to altitude, then set up a constant speed cruise and measure the distance (use DME or map feature) at equal time intervals; students record the data	HSA-SSE.A.1 HSA-SSE.A.1a HSA-SSE.A.1b

	and note how the series is arithmetic; students write a recursive rule for the series and discuss how this could be useful.	
Geometric series	Opening: If an airplane is taking off, what happens to its speed? Learning Target: I can fly the flight simulator profile and see how acceleration relates to a geometric series. Main activity: Students discuss rate and changing rate; students perform a take off in the flight simulator, noting the airspeed at equal time intervals from brake release to liftoff; students record the data and note how the series is geometric; students write a recursive rule for the series and discuss how this could be useful.	HSA-SSE.A.1 HSA-SSE.A.1a HSA-SSE.A.1b HSA-SSE.B.4
Linear functions (inquiry lesson)	Opening: What airplane performance variables might show linearity? Learning Target: I can fly the flight simulator profile and measure many variables on an airplane and determine if they are linear. Main activity: Students discuss what they think they can measure and which might be linear; students fly the flight simulator while non-flying group members measure different variables of their choice; students explain how they are measuring and what the variables mean; students check to see if the variables demonstrate linearity by graphing them; students find a function to represent any linear relationships; students present their results to the class and discuss them.	8.F.B.4 8.F.B.5 HSA-CED.A.1 HSA-CED.A.2 HSA-CED.A.3 HSA-CED.A.4
Slope	Opening: What airplane performance variable might relate to slope? Learning Target: I can fly the flight simulator profile and measure climb rate to determine slope. Main activity: Students discuss the concept of slope of a linear function; students discuss how climb rate would show slope; students determine what to measure on a climb to figure the slope (altitude vs. time); students take off and measure the airplane's altitude at set intervals while also recording the vertical speed; students plot the altitude as a function of time on a graph and measure the slope, then compare the calculation to the vertical speed; students discuss the results.	HSA-CED.A.1 HSA-CED.A.2 HSA-CED.A.3 HSA-CED.A.4
Data analysis – best fit	Opening: You are in a flight test organization, and you are tasked with determining a new airplane's climb rate – how will you measure it? Learning Target: I can fly the flight simulator profile and determine climb rate from data I get using best fit. Main activity: Students discuss the concept of linearity and best fit; students discuss how they would measure climb rate using several trials, understanding that each trial will give slightly different data due to human factors (different flying technique on each climb); students fly several climb profiles as closely the same as possible—same aircraft and conditions, same airspeed, same climb profile;	HSF-BF.A.1 HSF-BF.A.1a

	students plot each climb's data points (altitude vs. time); students note how the data is a scatter plot showing linearity; students use graphing calculators and their eyes to plot best fit of the data; students discuss the results.	
Statistics – mean, median, mode	Opening: Look at the previous lesson on best fit – could we use the data to find one climb rate? Learning Target: I can fly the flight simulator profile and get data to calculate mean, median and mode. Main activity: Students discuss the previous lesson where they performed several climbs and plotted the data from each to find the best fit; the students use the data to calculate the climb rate of each climb; the students discuss central tendency, then how they can calculate mean, median, and mode for the climb rate; students calculate mean, median, and mode, then compare the results to the best fit line.	HSS-ID.A.1 HSS-ID.A.2 HSS-ID.A.3 HSS-ID.A.4
Trigonometry – calculating a descent gradient	Opening: You are a 747 airline captain flying to JFK airport from London—you are cruising at 39,000 feet—at what distance from JFK do you need to start to descend for a comfortable/normal descent? Learning Target: I can fly the flight simulator profile and use trigonometric relationships to calculate a descent gradient. Main activity: Students review trigonometric relationships; students think about the descent problem; students plot the airplane on a graph, 39,000 feet up and an unknown distance from JFK—a comfortable descent is at 3 degrees nose down; students use tangent to calculate the distance from the airport to start descent; students fly the profile in the simulator to test it; students experiment with higher and lower angles (calculating distance, then measuring it) to see how they work; students discuss the results.	HS-SRT.C.6 HS-SRT.C.7 HS-SRT.C.8
Law of cosines	Opening: How does a crosswind affect an airplane's route of flight? Learning Target: I can calculate the effect of a crosswind using the law of cosines. Main activity: Students discuss how a crosswind would affect an airplane's route of flight; students understand that a 90 degree crosswind makes a right triangle so the Pythagorean Theorem could be used to find the resultant route; students learn the law of cosines, then calculate the route with information given; students test their calculation by flying the same route with the same crosswind; students compare the flight results with the calculations.	HS-SRT.D.10 HS-SRT.D.11