Dynamic Design: Launch and Propulsion

Weather or Not

STUDENT ACTIVITY

BACKGROUND INFORMATION

In order to have a successful launch, not only do all of the rocket systems and subsystems have to be in order, but the conditions at the launch site and in the direction the rocket is moving toward have to be optimal for launch. The Delta has specific weather constraints that are coordinated with the range. The launch weather o
fficer monitors cloud cover, knowing how close clouds can be to the launch site and how deep the clouds can be. The upper level winds are measured with balloons that go up at six hours before launch. The balloons give a profile of the winds. This information is fed back to Boeing at Huntington Beach CA, and compared with the constraints of the rocket for that mission.

Listen to this audio of Kris Walsh explaining launch period and launch window. The **launch period** is the number of days the rocket can be launched into the proper orbit. For a low-Earth orbit like most shuttle missions, there is no concern it can happen any day. For missions going to Mars, L1, or asteroids, the launch period is limited because of energy needs to be imparted to the spacecraft. The mission might use a planet or the moon to get into the proper orbit. The launch team works with the spacecraft provider to determine the target. The rocket gets the spacecraft to the target with certain energy then the mission designers take over.

The **launch window** is the time period on the day of launch that a rocket can be launched. The launch window changes on a day-to-day basis, which ranges from one second to one hour. If the launch window is twelve minutes or more there is more flexibility. If there is more than one window and a problem occurs, the rocket could still fly that day. According to Boeing mission integration officer Kristen Walsh, “If there is a problem with the launch countdown, then we can safe the vehicle, recycle, and attempt again that same day.” If the launch window is less than 12 minutes and there is a problem, then the delay will be 24 hours.

In the next phase of this module, your design teams will take all of the information that you learned in your expert groups and apply it to building a water rocket that can fly as high as possible. For the launches that will take place in the competition, your teacher will set the launch period. The launch window should be twelve minutes. That means if your team cannot launch your water rocket in twelve minutes, you will have to launch during the next launch period. In this activity your group will determine what weather conditions are acceptable for launch, and what weather conditions should cause a delay.

PROCEDURE

1. Using the information in the background above, work in your design groups to develop the weather constraints for launching a water rocket.

2. For each of the following conditions, write the minimum conditions that the safety officers and the teacher will use to determine if a launch will occur. As you develop the conditions, include a rationale for this requirement.

Weather Component	Conditions Necessary	Method of Measurement	Rationale
Wind Speed			
Wind Direction			
Visibility			
Temperature			
Precipitation			
Cloud Cover			

3. On the Internet go to http://www.weather.com/ and enter the zip code of the launch site that you will be using. Record the current conditions below and whether or not you could launch today based on your team's criteria.

4. Take notes about other group's criteria. What are the similarities and the differences? Think about how the class should come to a consensus for determining the conditions necessary for launch.