Dynamic Design: Launch and Propulsion

Genesis Launch Vehicle: The Delta Rocket

TEACHER NOTES: POWERPOINT PRESENTATION

BACKGROUND INFORMATION

The PowerPoint presentations, provided as a supplement to the student texts from which they were derived, are always offered as a portable document format (pdf) file for those teachers who do not have the Microsoft® PowerPoint application.

Because teacher use of the presentation slide notes as talking points is vital for complete understanding of the concepts, the slide notes from the PowerPoint are provided here for those teachers using the pdf presentation. Therefore, it is important to read and print out these talking points before presenting the material to your students. You may wish to use the teacher guide that accompanies this presentation for additional tips, delivery strategies, and correlation to the national standards.

SLIDE NOTES/TALKING POINTS

Slide 1: None.

Slide 2: Although Explorer I was the first U.S. satellite launched into space, it was not the first in the world. The Soviet Union launched Sputnik on October 4, 1957. Because the Soviets were able to launch a satellite into space, there was concern that the Cold War foe could strike United States soil with a missile. With this launch, the United States was in second place in the race for space. In the field of education, this ushered in a sense of urgency for science and mathematics education.

The Teacher Guide, “Pop Rocket Variables,” has more information about Sputnik, including a recommendation using clips from the move “October Sky.”

Optional activity: Listen to the sound of the beeping radio signal that Sputnik made. *http://www.hq.nasa.gov/office/pao/History/sputnik/sputnik.wav*

Slide 3: Students should observe the diagram on this slide and describe the differences in the rockets. Ask students about the particular specifications that would require larger rockets. (Students may suggest that greater mass or size of spacecraft may require larger rockets with a greater thrust.) Ask students why it would be beneficial to use the smallest rocket possible. (Students may suggest that smaller rockets would be less expensive and require less fuel than the larger rockets.) At this point, you may want to complete the Student Activity, “Choosing a Launch Vehicle for Genesis,” if you have not already done so.

Slide 4: This slide asks students to think about what the number 7326 represents. Before moving on to the upcoming slides that detail this, allow students to speculate. Encourage them to write their answers on an index card. Students who have read the student text in advance of this PowerPoint might know all or part of the answer.

Slide 5: Point out the first stage of the Delta Rocket by pointing to the bottom left-hand section of the diagram. Emphasize that the first stage has a liquid fuel tank and solid fuel boosters strapped on. (In the case of Genesis, three of these boosters were strapped on.) Ask students why there is a different number of strap-on boosters for various spacecraft. (Students may suggest that this the number of boosters could be increased or decreased for spacecraft that might have similar dimensions, but different masses.)

Optional activity: View the video clip, "The Boeing Delta 7326."
http://www.genesismission.org/educate/scimodule/kriswalsh/Boeing_delta_video.html

Slide 6: As you discuss the first paragraph on this slide, point out the middle section of the diagram as being the second stage. Emphasize that there are liquid fuel tanks and guidance electronics beneath the fairings on the second stage.

Point out the third stage as the top, right-hand side of the diagram. Emphasize the fact that the Genesis spacecraft sat on top of the third stage. Ask students to notice the configuration of the spacecraft. (The solar panels are folded.)

Show students Table 1 in the student text. This shows the first five Discovery missions, the mass of each spacecraft, and the name of each launch vehicle. Based on the launch vehicle numbers, what can you tell about the Delta launch vehicles used by the Discovery missions? (Note: Lunar Prospector did not use a Delta launch vehicle, but an Athena rocket.)

Slide 7: Tell students that the Echo I reflected a radio message from President Dwight D. Eisenhower across the United States, demonstrating the feasibility of global radio communications satellites that we depend on so much in 21st century. Explain that the image on this slide shows technicians as they examine the Echo satellite payload. It was a 26-inch diameter magnesium sphere. At the time, it was the largest satellite lifted into orbit.

Slide 8: Explain that the Orbiting Solar Observatory (OSO) was launched on Delta 8, and that the observatory helped study the sun in the ultraviolet, x-ray, and gamma regions of the electromagnetic spectrum. Explain that one of the discoveries made by OSO was the sun's coronal holes.

Slide 9: Delta 11 transmitted a live television program from Maine to stations in England and France. Explain that over the years, the Delta was a "workhorse" for the U.S. Space Program. The Delta's launched the Pioneer space probes that NASA used to explore the planets in our solar system.

Slide 10: Ask students why they think the space shuttle caused the Delta program to cease in 1984. (Accept all reasonable responses. Some students might say that the shuttle had a larger payload. Others may say that the shuttle could take satellites to orbit and astronauts could perform experiments at the same time.)

Slide 11: Ask students what they think the term "**geosynchronous**" orbit means. Allow students to offer some explanations. You may want to help students break the word down.

- **geo** – the Earth
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- **synchronous** – happening at precisely the same time
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- **Geosynchronous Earth Orbit (GEO)** – an orbit whose period is the same as the rotational rate of the Earth, so that the position of a satellite seems to stay in the same spot over the Earth

Slide 12: Have students use the data in this chart to calculate the success rate of the Delta for each decade and the overall success rate. See the Student Activity, "How Do You Spell Success?"

Slide 13: None.

Slide 14: Optional activity: Listen to the audio clip, "The Mating Procedure: Spacecraft to Rocket."
http://www.genesismission.org/educate/scimodule/kriswalshsoundfiles/mating_procedure.html

Slide 15: The image on this slide shows the Genesis spacecraft being encapsulated inside the fairing. The fairings have doors so that the spacecraft can be accessed. Ask students to think about why it is a good idea to have access to the spacecraft this close to launch. (Students may say that even at this late date there is always the possibility of technical problems that would require access to the spacecraft.)

Slide 16: The image on this slide shows the first stage of the Delta II rocket being lifted up the "gantry." The gantry contains cranes that are used to erect the rocket. On the opposite side of the pad from the gantry is the umbilical tower. This tower has lines that are used to load propellant and other components into the rocket.

Slide 17: The water dumped on the pad is momentarily turned to invisible steam. The force of the rocket exhaust blasts it away into the cooler air around the pad, causing the steam to condense as small water droplets, forming the familiar white cloud.

Approximately 35 seconds after launch, the rocket reaches “Mach 1,” or the speed of sound. Just after one minute into launch, the solid motors burn out and are separated from the rocket. Main engine cut-off occurs at four minutes after launch. At the five-minute mark, the fairing is jettisoned. After the third stage is separated, it burns, placing the spacecraft into the desired orbit. Then the launch team cheers.

Optional activities:

- Listen to the audio clip, “Genesis Launch Campaign Overview.” http://www.genesismission.org/educate/scimodule/kriswalshsoundfiles/launch_campaign.html

- View the Genesis launch replay: http://realserver1.jpl.nasa.gov:8080/ramgen/Video-GenesisLaunch-010808.rm?mode=compact

Slide 18: None.