Dynamic Design: Launch and Propulsion

Launching Genesis: Choosing a Launch Vehicle

STUDENT ACTIVITY

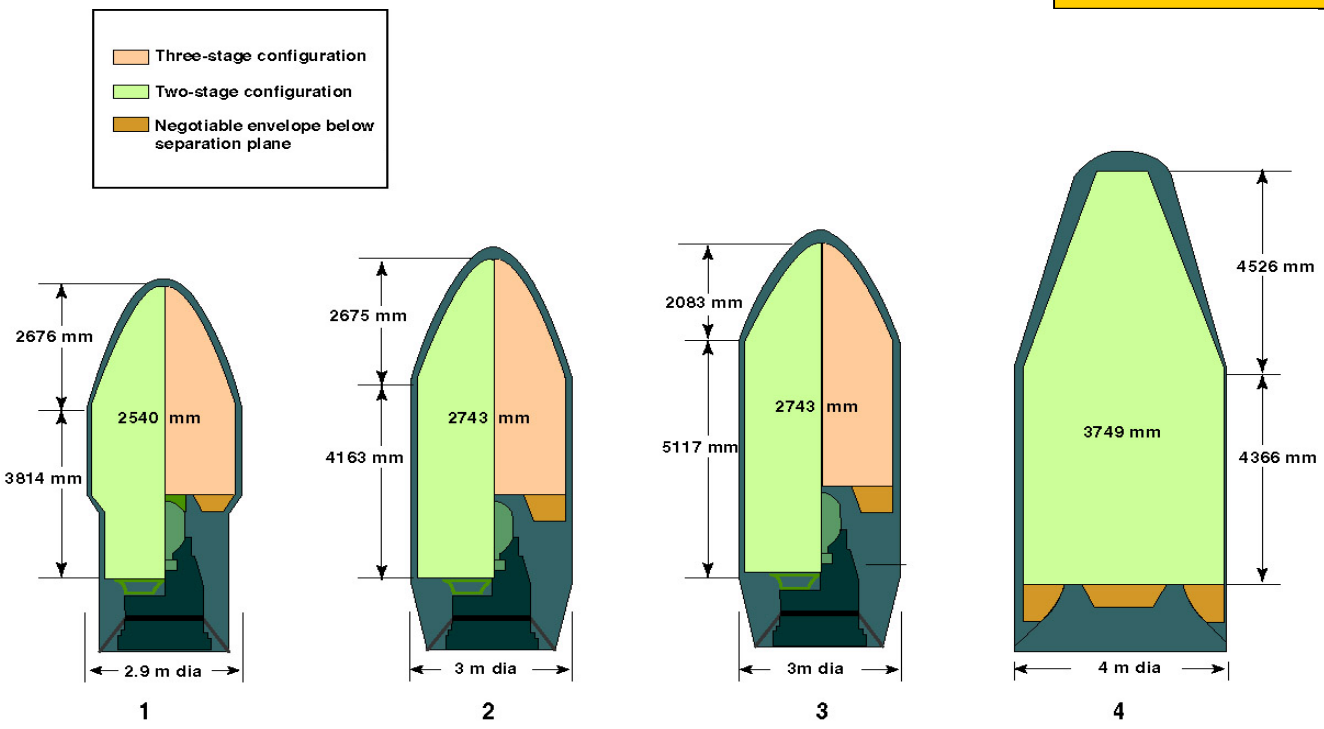
BACKGROUND INFORMATION

When engineers selected the appropriate rocket to launch the Genesis spacecraft, they considered the following requirements: 1) The rocket used must be capable of launching a payload of about 500 kilograms; 2) The payload fairing, which protects the Genesis mission payload during launch and flight ascent, must have a diameter of 9.5 feet (2.9 meters). Genesis mission planners chose to use the Boeing Company for their launch needs.

In this activity, you will be acting as a space engineer as you choose the most appropriate launch rocket, from several available Delta rockets, for the Genesis mission. The rocket chosen should be the smallest launch vehicle that will meet the volume and mass requirements of the Genesis mission.

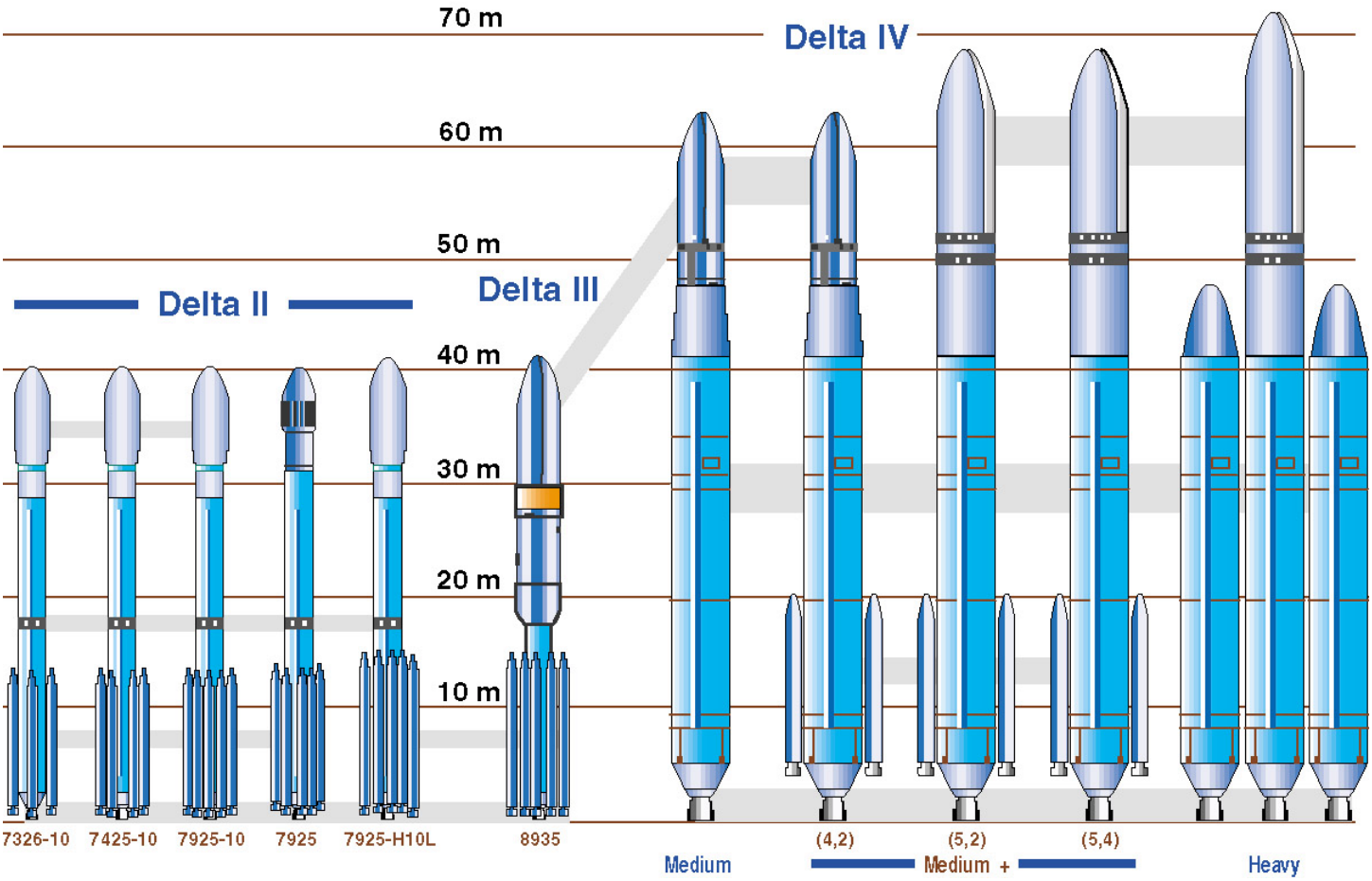
PROCEDURE

1. Look at the fairings from the following rockets. Using the background information, determine the smallest one that could be used to hold the Genesis spacecraft.



Write your choice and reason here:

2. Use the background information and the chart below to choose the smallest rocket that could be used to launch the Genesis spacecraft.



Delta II/III Genesis Mission Performance Capability

Perigree Altitude = 100 nmi – C3 = -0.66 km2/sec2 – Inclination = 28.5 deg

Fairing	Payload Capability (lbs)		Payload Capability (kg)	
Delta II Vehicle Configuration	9.5	10	9.5	10
7326	1400	1350	635	612
7426	1600	1550	726	703
7425	1810	1760	821	798
7920	1570	1420	712	644
7925	2890	2770	1311	1256
7920H	2050	1980	930	898
7925H	3410	3340	1547	1515
Delta III = 4-meter Fairing	6090		2762	

Write your choice and reason here:

3. The following table includes information about the mass of other Discovery spacecrafts that have already launched. Based on mass only, what launch vehicle could they have used? Using the Internet as a resource, find out what launch vehicle was used. If the Internet is not available, your teacher may help you find this information.

Discovery Mission	Spacecraft Mass	Potential Launch Vehicle	Mass Capabilities
NEAR	805 kg		
Mars Pathfinder	890 kg		
Lunar Prospector	1,896 kg		
Stardust	380 kg		
Genesis	494 kg		

4. Use the mission and spacecraft mass information in the chart to make a double bar graph showing the mass of the spacecraft for each mission with one bar, and the mass capabilities for the potential launch vehicle for the other.