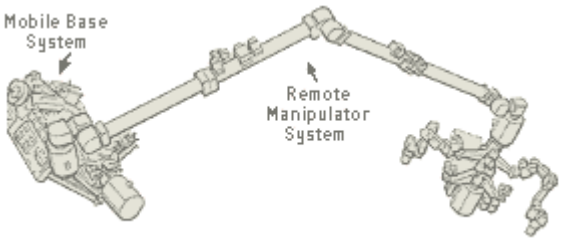
Student Name _____ Date _____

CANDARM WRESTLING



Canada is contributing an essential component of the International Space Station, the Mobile Servicing System, which is also known as the MSS. This robotic system plays a key role in Space Station assembly and maintenance. It moves equipment and supplies around the Station, supports astronauts working in space, and services instruments and other payloads attached to the Space Station. Astronauts receive robotics training to enable them to perform these functions with the arm.

The Space Shuttle already uses Canadarm for many of its purposes in orbit. It is used to unload the cargo bay of the Shuttle, maneuver satellites in orbit, and perform assistance to astronauts during Extravehicular Activity (EVA). The ISS will use Canadarm2 to help construct the rest of the Station by moving parts, equipment, and aiding astronauts during EVA.

Both robotic arms were built in Canada, but each is unique in its own way. Canadarm is attached to the Shuttle, so it cannot move from its fixed position and always returns to Earth after each mission. Canadarm2 is attached to a Mobile Base System that allows it to move along the ISS, so it stays in orbit all the time. Canadarm has 6 degrees of freedom, similar to a human arm; while Canadarm2 has 7 degrees of freedom, making it very much like a human arm. Canadarm's elbow rotation is limited to 160 degrees, while Canadarm2 can make a 540-degree turn. The Canadarm2 has been equipped with force and optical sensors to give it a feeling of touch and sight. Canadarm is 15 meters [m] in length, with Canadarm2 being 17.6 m. The Canadarm seems to be really heavy at 410.5 kilograms [kg] until you compare it to the 1,800 kg of the Canadarm2. In terms of size, the Canadarm is 33 centimeters [cm] in diameter, and the Canadarm2 is 35 cm in diameter. This is due to Canadarm having 16 layers of carbon fiber for protection, and Canadarm 2 having 19 layers of carbon fiber. Canadarm2 was able to handle more mass than Canadarm until recently. Canadarm2 can handle 116,000 kg, with Canadarm handling 266,000 kg. In terms of speed, the Canadarm can move at a speedy 60 centimeters per second [cm/s] unloaded, and 6 cm/s fully loaded. Canadarm2 moves slower at 37 cm/s unloaded, and about 2 cm/s fully loaded. For external viewing, Canadarm has two cameras and Canadarm2 has four cameras.

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CANDARM WRESTLING

Directions: In today's activity, you will have to read and record information about the Canadarm and Canadarm2. Once the information has been recorded, you can answer the questions at the end.

1. Compare the Canadarm and Canadarm2, read the Background Information and fill in the chart below. If there are units with your answers, be sure to include them.

Detail		Canadarm	Canadarm2
Location			
Degrees of Freedom			
Joint Rotation			
Sensors			
Length			
Weight			
Diameter			
Protection thickness			
Speed	**Loaded**		
	Unloaded		
Mass Handling			
Cameras			

Student Name _____ Date _____

CANDARM WRESTLING

2. Answer the following questions:
   a. Based on your data table, which Canadarm is best? _____

   _____

   b. Give three specific reasons from your chart to explain your answer to question a? _____

   _____

   _____

   c. What feature of the Canadarm surprised you? In other words, list something you did not already know. _____

   _____

   _____

   d. What feature of the Canadarm2 surprised you? In other words, list something you did not already know. _____

   _____

   _____

3. In the space below draw an activity that could be completed on the space shuttle or ISS using the Canadarm or Canadarm2.