Name:			Date:
EXPLORATION EXTENSION	**2**	**Crawler-Transporter**	***Background, Materials & Instructions***

Background

The Crawler-Transporter is used by NASA to transport the Space Transportation System (the Space Shuttle and fuel tanks) from the Vehicle Assembly Building (VAB) to the launch pad on a Mobile Launcher Platform (MLP). It travels at approximately 1 mph and has to negotiate turns and an uphill incline of five percent and still keep the Space Transportation System steady. It's approximately 4.2 miles from the VAB to launch pad 39B, which is commonly used for Shuttle launches.

Your mission will be to construct a rocket, design and create a MLP, and transport your rocket safely from the VAB through the **Mission 3** maze to the launch pad on your own Crawler-Transporter (robot).

Materials

Same as **Mission 3** plus:

❏ 1 Estes Alpha Rocket or Similar Rocket

❏ Popsicle Sticks, Straws, Foam Meat Trays (unused)

❏ Glue or Glue Gun

Instructions

Build a rocket according to your teacher's and manufacturer's instructions.

On graph paper, design a mobile launch platform that will support your rocket and fit on the robot. The design must keep your "multimillion dollar rocket" secure through turns and rises in elevation. It must also allow for access to the calculator buttons needed to run the robot. Use your design to build a mobile launch platform from materials provided by your teacher.

Name:			Date:
EXPLORATION EXTENSION	**2**	**Crawler-Transporter**	***Challenge & Results***

Challenge

The maze from **Mission 3** will represent the "Crawlerway" at Kennedy Space Center (KSC) which connects the VAB to the launchpad. Use your Crawler-Transporter (robot+MLP) and the **MAZE** program to transport a rocket from the beginning of the Crawlerway to the end. Your successful transport of the rocket determines the types of rocket engines you can use as follows:

Two straight-aways and a curve: Eligible for A engine

Three straight-aways and two curves: Eligible for A or B engine

Four straight-aways and three curves: Eligible for A, B, or C engine

Results

1. Did you have to change the time durations in the **MAZE** program for the successful transport of the rocket? If so, why did that occur?

2. When NASA's Crawler-Transporter is loaded with the MLP and the Space Transportation System, it weighs about 17 million pounds and creeps along at only one mile per hour. Calculate which is faster the Crawler-Transporter or a robot that travels at 20 centimeters per second?

By how many centimeters per second?

3. The Crawler-Transporter has to keep the Space Transportation System vertical as it goes up a 5% incline ramp at the launchpad. On a separate sheet of paper, draw a design of how you would keep your rocket vertical if the robot had to go up a 5% incline. Label all parts of your diagram.

(For more information about the Crawler-Transporter, see your teacher for Web sites.)

Estes Alpha Rocket bulk pack is useful for this exercise. When students are creating their mobile launch platform use all appropriate safety precautions. In this exercise, the MLP is only for transporting the rocket and not for launching

Follow all manufacturer's recommendations and the NAR's Model Rocket Safety Code when building and launching rockets. The early portions of the movie *October Sky* is informative as to what NOT to do when building and launching rockets.

As an added challenge, a 5% incline ramp could be added to the end of students' Crawlerways.

For **question 1**, the weight and placement of the MLB and rocket may change the traveling and turning characteristics of the robot. For **question 2**, at one mph NASA's Crawler-Transporter is traveling at 44.7 cm/s. It's faster by 24.7 cm/s. For **question 3**, answers will vary. The Crawler-Transporter uses hydraulic lifts to keep the Space Transportation System vertical as it goes up the incline at the launch pad.

The following Web sites may be helpful:

http://www.nar.org/NARmrsc.html

http://science.ksc.nasa.gov/facilities/crawler.html

http://en.wikipedia.org/wiki/Crawler-Transporter

http://www.cdli.ca/CITE/sts_rollout.htm

http://www-pao.ksc.nasa.gov/nasafact/count3teaf.htm