**SLIDE # 23: Energy Monitoring**

Energy monitoring is a mandatory NASA RMC requirement.

It is clearly stated in the contest rules that each team will lose one point for each Watt-hour of energy consumed. So, to fairly award and deduct points each team must display energy consumption by an electrical data logger.

We purchased this handy watt meter online to do the job. It displays Watt-hours, charge, current, voltage, power and variety of other useful information.

**SLIDE # 24: On-Board Diagnostics Monitor**

On-board diagnostics is not a requirement but a feature we decided to include so that we can better understand our robot. The monitor will display error messages and current drawn by the linear actuators and motors as well as temperature information to make sure we are not overheating the electronics. Basically, through this diagnostics tool we hope to know the limits of our robot in order to safely operate it.

**SLIDE # 25-27: Autonomy, Raspberry pi, Arduino**

Explain: Autonomy. Then: READ INFO ON SLIDE. Breeze through!

**SLIDE # 28: Image Processing for Autonomy** (giving the robot eyes and a brain)

I used: a **Blob Detection** technique whichdetects pixels of a certain color and finds the mean accumulation point of those pixels - In our case, red.

Application: Most probably use a satellite robot **(MINI ME!!!!)**. This robot will detect the red line then communicate to the bigger robot when to begin digging.

Space for Improvement: #1 - Canceling out **ambient light** - with the use of LED's around the camera

#2 - The algorithm in the program works very quickly but the **image gathering is slow** (responds about 8 to 20 seconds late) - make it grab fewer pictures hopefully making it faster this will also help reduce the amount of processing used.

#3 - **Motion blur** - This we hope will be fixed with less image grabbing and slower movement of the robot. We are currently still testing and trying to correct for error.

**SLIDE # 30: Obstacle Avoidance**

READ OFF SLIDE. Then say: This will help us make sure that our robot does not tip over especially when it is carrying the excavated material back to the collection bin.

**SLIDE # 31: Obstacle Avoidance Concept**

This diagram explains how we will place the sensors above the wheels to help give us the most optimum sensor readings to accomplish our task. Also, please note that the sensors are facing slightly towards the ground because we are only allowed to detect obstacles NOT the walls. This is because NASA stated in the RMC rules that “Mars has no walls!” So if the robot encounters a wall it will detect it as any other big rock and avoid it.