Mapping Unknown Surfaces
Teacher Version

Adapted from an activity entitled "Mapping Unknown Surfaces" from the American Museum of Natural History web site at www.amnh.org/rose/mars/mapping.html

Introduction & Purpose

Most people do not often think about how scientists arrive at data about other planets. Much of this information is gathered indirectly. One example is the creation of three-dimensional maps. Scientists use radar and photographs to compile three-dimensional maps of far away planets using techniques similar to those used in this activity. This activity should get your students thinking about how difficult it is to take meaningful measurements of other planets, and just how amazing it is that we know so much about other planets without ever having been there ourselves.

Objective

Students will simulate radar data collection to determine if a safe landing site exists on a landscape. They will also use this data to create a topographical map of the landscape.

Materials Needed

- Shoebox or similar cardboard box with a lid
- Modeling clay, Playdoh©, stucco, or rocks
- Awl or similar long, narrow, sharp pointed tool - **be careful!**
- Data sheet (in Student Version)
- A few wooden skewers
- Pencil
- Marker
- Idaho TECH Lab Notebook

Procedure

1. **Create a landscape box** - Create an uneven landscape in a box, including craters, mountains, and valleys, using modeling clay, Playdoh©, or similar materials. Leave at least one 4 centimeter by 4 centimeter square area relatively flat within the box, with less than a one centimeter change in elevation, which will serve as a landing site for spacecraft (you can leave more than one if you wish). Use an awl or similar tool to punch holes in the box lid approximately 2 cm apart in a grid-like pattern (use the data sheet in the Student Activity Book as a guide). Finally, label the grid -- letters across the top, and numbers down the side.
2. **Make data collection instruments** - On the wooden skewers, measure out and draw centimeter markings with a marker so the students can use them as measurement tools.
3. After this preparation is complete, have the students refer to the directions in the Student Version to complete the activity. Each student will take several measurements through each hole with a skewer, and then record each measurement on their data sheet next to the corresponding dot. Have the students record their data consistently - for example, always above the dot, always to the right of the dot, etc. for data accuracy. The students will have to try to determine if there is a safe landing site for a spacecraft using their collected data. Have the students hypothesize where a safe landing site may be from the initial measurements taken. Finally, have the students connect an area of dots that contain equal measurements on the data

sheet to make a topographical map (see example below). This may be a difficult concept for them to grasp, so be sure to provide plenty of explanation before the students begin to make the map. It may help to draw an example on the board, explaining your thought process as you make the topographic map, to help your students understand the concept.

4. Once the students have created their topographic map, have them review their hypothesis, changing it if necessary. Then allow them to open the box and look at the real landscape. Have the team record their observations, ideas and thoughts in their Lab Notebook.
    - Are all of the features of the landscape represented on the map?
    - Which ones did they miss? Why?
    - How accurate is the radar method they used? How could they improve the accuracy? (One idea is to take measurements closer together by using a finer-scale grid.)
    - Is the selected landing site in the box really a safe place for a spacecraft to land? Why or why not? .