



Comet Tracking Team Instructions

Overview

Your team calculates three things:

- 1) The estimated time of impact (ETI). This is the number of hours before the comet is expected to crash on the Moon.
- 2) The size of the crater. The size and speed of the comet determine this.
- 3) The distance reached by ejecta. When the comet strikes the Moon, it kicks up debris. This debris is called ejecta. The debris is usually very small, like sand and pebbles, but it can contain larger pieces of rock. It can travel as fast as a bullet fired from a gun. The ejecta can be very dangerous to any astronauts in the area.

Team Tasks

Choose people to fill the following roles:

Member 1, Team Leader: Help team members solve any problems during the mission. Make team decisions. Work with the Communications Team, Crisis Management Team, and Moon Mapping Team.

Member 2, Recorder: Record data on your worksheet. Work with members 3 and 4.

Member 3, Data Analysis: Make calculations on the worksheet. Give information to the Crisis Management Team.

Member 4, Data Analysis: Make calculations on the worksheet. Give information to the Moon Mapping Team.

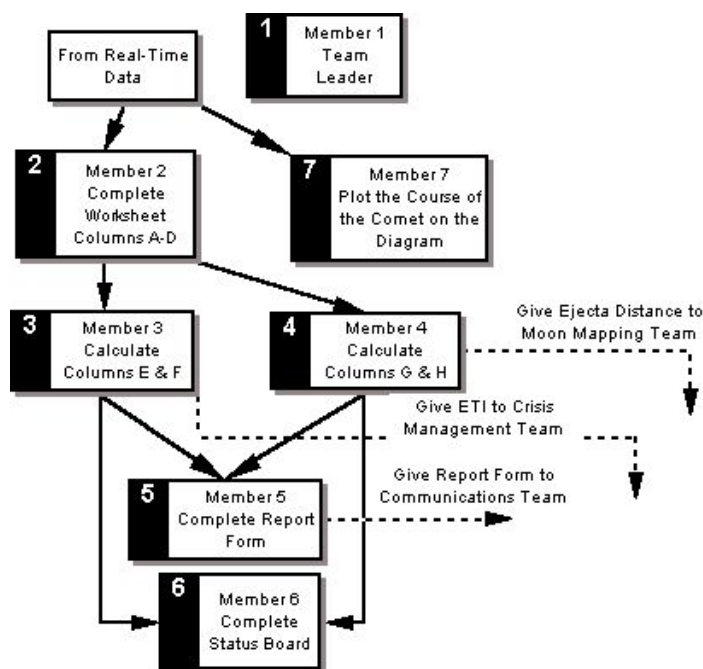
Member 5, Runner: Complete the report form with information from your worksheet. Give it to the Communications Team.

Member 6, Recorder: Update the status board with important information.

Member 7, Mapping: Plot the path of the comet on the comet tracking diagram. Post it on the status board.

Note: You can combine these tasks if you have fewer than seven members on your team.

- For a three-member team combine the tasks of members 1 and 2 and members 3 and 5; skip members 6 and 7.
- For a four-member team combine the tasks of members 1 and 5; skip members 6 and 7.
- For a five-member team skip members 6 and 7.
- For a six-member team skip member 6 or 7.



Detailed Instructions

Member 1

Make sure every team task is taken care of by someone on the team, especially in case someone is absent. Also make sure the team has enough copies of the team instructions, worksheets, report forms, and calculators.

During the mission make sure your team is receiving data, making calculations, and giving information to the Communications Team and other teams. You should handle any problems that pop-up.

Member 2

Your team needs one computer. It will transmit data to you via satellite.

- a) Get online. If the computer is not already on the correct web site, open your Internet web browser and go to <http://www.e-missions.net/flashcom/targetmoon> At the start of the mission, the Flight Director will provide the Communications Team the password for this site.

- b) Select “Comet Tracking Team.” You should see a message that says, “Connecting to Satellite.” Now you should wait for about 10 minutes after the mission begins until the Flight Director signals your team to examine the data.

Once every five minutes, new data on the comet will appear. The data comes from telescopes and radar on Earth. Each reading corresponds to a half hour of real time.

- c) Record data on the Comet Tracking Team worksheet in columns A, B, C, and D. The UTC time goes in column A. The diameter of the comet goes in column B. The distance to the moon goes in column C. The speed of the comet goes in column D.
- d) Give this information to members 3 and 4.

Member 3

- a) From member 2 get the distance to the moon from column C and the speed of the comet from column D.
- b) Calculate column E: **estimated time of impact**. To do so, divide the **distance to the moon** (column C) by the **speed of the comet** (column D) to calculate the **estimated time of impact**

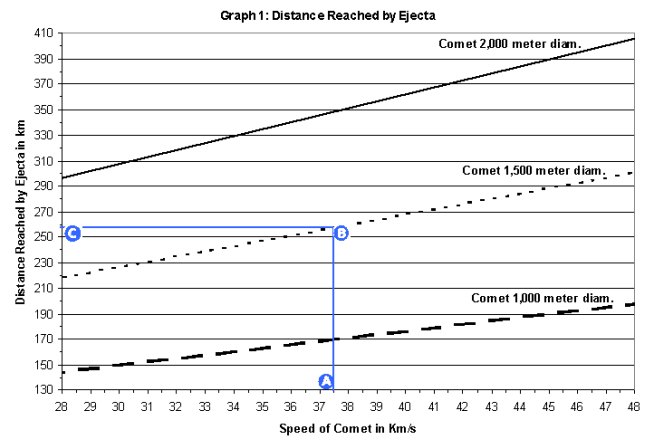
(ETI) in seconds. Round the answer to the nearest whole number.

$$\text{Column E} = \text{Column C} \div \text{Column D}$$

- c) Calculate column F: **ETI conversion**. To do so, divide the **ETI in seconds** (column E) by 3,600 to calculate the **ETI in hours**. Round the answer to one decimal place.
- $$\text{Column F} = \text{Col. E}/3600$$
- d) Write the **UTC time** and the **ETI in hours** on two sticky notes. Give one note to the Crisis Management Team. Give the other to member 6. (If you do not have a member 6, you do not need a second sticky note.)

Member 4

- a) From member 2 get the **diameter of the comet** from column B and the **speed of the comet** from column D.
- b) Refer to Graphs 1 and 2 at the end of this document. Determine the **distance reached by ejecta** (column G) using Graph 1:
- Find the **speed of the comet** (column D) on the X axis (Speed of Comet in km/s). See **A** on the diagram below.



- Use **diameter of the comet** (column B) to determine the correct diagonal line to use in the next step. Find that line on the graph.
- Put a ruler or other straightedge on the graph. Lay it so the edge goes straight up from **A** to the diagonal line. The place where the straightedge crosses the diagonal line is **B**.
- Lay the straightedge so it goes straight from **B** to the Y axis (Crater Diameter in Kilometers). The place where it crosses the Y-axis is **C**. This is the

diameter of the crater in km. Record this number in column G on the worksheet.

- **Example:** Use the diagram. Suppose the speed of the comet (column D) is 38 km/s. The diameter of the comet (column B) is 1,500 m. Find 38 (A) on the X axis. Use a straightedge to make a line that goes up and down through 38. Follow this line up to the line labeled 1,500 m (B). Use the straightedge to make a line that goes from this point on the line to the Y axis. The point where the line crosses the Y axis (C) is the distance reached by ejecta in kilometers. In this case the distance is about 260 km.

c)



CRITICAL! Write the distance reached by ejecta and the UTC time on two sticky notes. **IMMEDIATELY**

GIVE ONE NOTE TO THE MOON

MAPPING TEAM. This is very important. The moon mapping team must receive this information. Give the other to **member 6**. (If you do not have a member 6, you do not need a second sticky note.)

- d) Determine the **size of the crater** (column H) using Graph 2. Follow the directions you used before with the graph and straightedge to determine the **crater diameter** in kilometers. Record this number in column H on the worksheet.

Member 5

After each row on the worksheet is completed, **member 5** must complete a report form with the new calculations from **members 3 and 4**. Give the form to the **Communications Team**.

It is important that this form is completed and given to the right people about every five to six minutes.

Member 6

- a) Before the mission get a large white board or chalkboard. This will be the status board. Place it where other teams can see it. This allows each team to know what is going on with your team at a glance.
- b) On the board record the **UTC Time** (column A), the **ETI in hours** (column F), **size of crater**

(Column G), and the **distance reached by ejecta** (column H). Any important events should also be noted on the status board.

Member 7

Your task is to provide a visual representation of how close the comet is to the **Moon**. Many people cannot understand that in the solar system, a distance of 500,000 km is actually quite small.

The location of the comet can be drawn on the comet tracking diagram. The diagram is a view from space of Earth, the Moon, and the comet's path. You will plot the comet on the path as it comes toward the **Moon**. Your drawings need only to be approximate—enough to get an idea of how close the comet is and how fast it is moving.

- a) Find the scale at the bottom right corner of the diagram. The scale shows the real distance represented by the length of the line on the diagram.
- b) Use a compass (or a ruler) as a measuring tool. Hold the point of the compass on the “0” on the scale. Extend the compass until the pencil reaches the “50,000” on the other end of the scale. The distance between the two ends of the compass represents 50,000 km in space.
- c) Starting at the **Moon** on the right, mark and label the line every 50,000 km. That is, the first mark would be 50,000, the second 100,000, the third 150,000, and so on until you reach the end of the line on the left.
- d) Every five minutes your team will receive data about the comet's **distance to the moon**. Use this data to draw a large dot where the comet is on the line:
- Round the distance to the nearest 10,000. For instance, if the distance given was 416,765 km, you would round to 420,000.
 - Plot the location **approximately** where it would be on the line. For instance, 420,000 is a little less than halfway between 400,000 and 450,000.
- e) Label the dot with the UTC time given in the data.
- f) Get the **ETI** from **member 3**. Write the ETI above the dot.
- g) Post the diagram on the status board after each update.

Comet Tracking Team: Graphs 1 & 2

