



# Moon Mapping Team Instructions

## Overview

Your team calculates two things:

- 1) The area of the zone of probable impact (ZOPI). This is where there is a 95 percent probability that the comet will hit.
- 2) The probability for each base that the comet will destroy it. This is the ratio of the smaller danger area near the base to the larger area of the ZOPI.

## Team Tasks

Choose people to fill the following roles:

Member 1, Team Leader: Help team members to solve any problems that occur during the mission. Make team decisions. Work with the Crisis Management Team, Comet Tracking Team, and Communications Team.

Member 2, Data Analysis: Record data, make calculations, and give information to members 4, 5, 6, and 7.

Member 3, Computer Analysis: Use the online moon map to record data, make calculations, and give information to members 4, 5, and 6.

Member 4, Base A Safety: Use information from members 2 and 3 to determine the probability of danger to Base A.

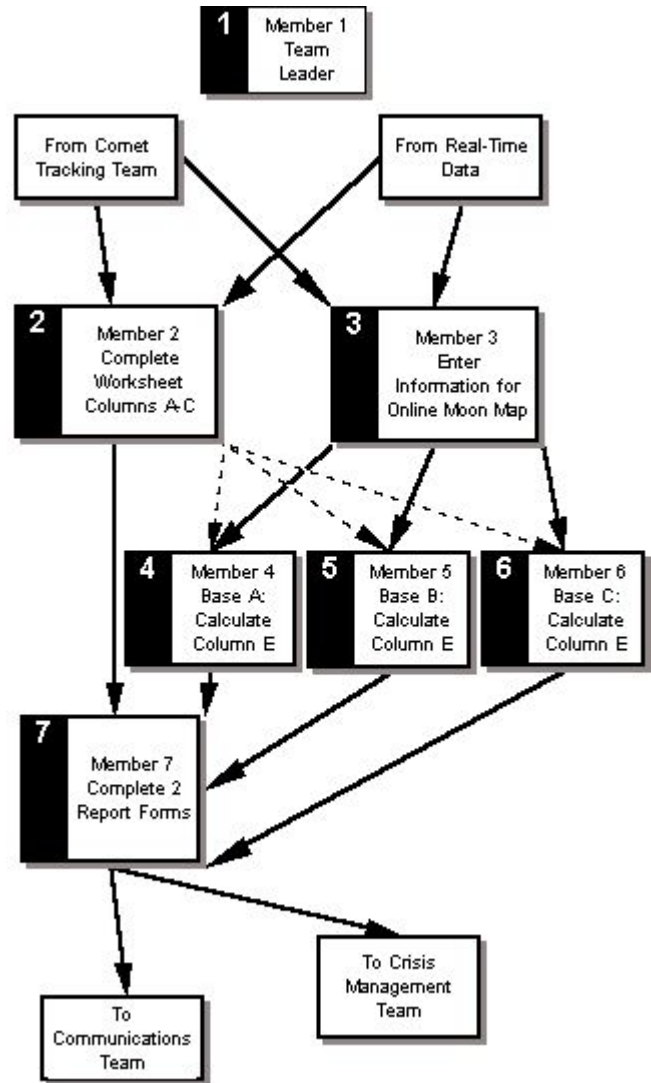
Member 5, Base B Safety: Use information from members 2 and 3 to determine the probability of danger to Base B.

Member 6, Base C Safety: Use information from members 2 and 3 to determine the probability of danger to Base C.

Member 7, Runner: Complete two report forms for each data reading. Give one to the Communication Team. Give the other to the Crisis Management Team.

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

- For a four-member team, combine the tasks of members 1 and 7, 2 and 4, and 5 and 6.
- For a five-member team, combine the tasks of members 1 and 7, and 4, 5, and 6.
- For a six-member team combine the tasks of members 1 and 7.



## Detailed Instructions

### Member 1

Make sure every team task is taken care of by someone on the team, especially if 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 problems that pop up.

### Member 2

Your team may use two computers (optional). One computer will transmit data to you from Earth. You will use it. The second computer is for the online moon map. Member 3 will use it.

- 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.

- Select "Moon Mapping Team." You should see a message that says, "Connecting to Satellite." Now you should wait 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.

- Record the data on the Moon Mapping Team worksheet. The radius of the ZOPI goes in column B.
- Determine the area of the ZOPI and record it in column C. The ZOPI is a circle. The formula for the area of a circle is:

$$A = \pi r^2$$

To calculate the area of the ZOPI, use 3.14 for the value of  $\pi$  (Pi). Use the radius listed in column B for the value of  $r$ . Record your answer in column C:

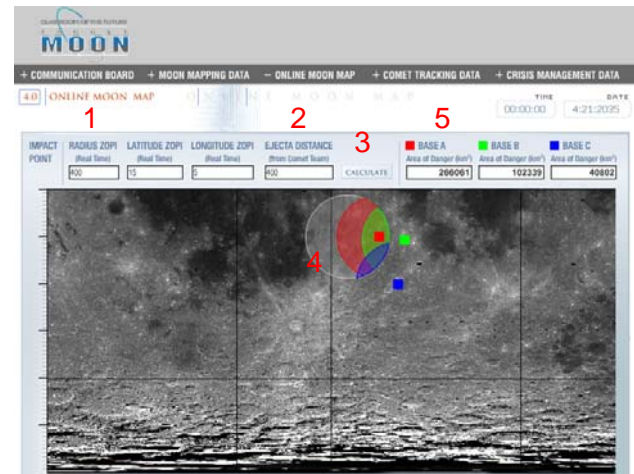
column C= 3.14 times column B squared

- Give the area of the ZOPI to members 4, 5 and 6 for their calculations and to member 7 for the report form.

### Member 3

Your team may use two computers (optional). Your computer is for the online moon map.

- Get online. If the computer is not already on the correct web site, go to <http://www.e-missions.net/flashcom/targetmoon> and select online moon map from the dropdown menu.



- Get the latitude, longitude, and radius of the ZOPI from data computer or member 2. (See #1 on the diagram.)
- Get the ejecta distance from the Comet Tracking Team. (See #2 on the diagram.)
- Enter the data in the appropriate boxes and click the "Calculate" button. (See #3 on the diagram.)
- Note the colored areas on the map: The ZOPI is light gray. The base A area of danger is red. The base B area of danger is green. The base C area of danger is blue. (See #4 on the diagram.)
- The area of danger for each base is in the box next to the base name. It is recorded in square kilometers (km<sup>2</sup>). Give this information to members 4, 5, and 6. (See #5 on the diagram.)

### Members 4, 5 and 6

a) Get the area of danger for your base (either A, B, or C) from member 3. Record the area data in column D on your worksheet.

b) Calculate the probability that your base will be destroyed.

$$\text{probability of destruction} = \frac{\text{area of danger}}{\text{area of the ZOPI}}$$

OR,

$$\text{probability of destruction} = \frac{\text{column D}}{\text{column C}}$$

There is a 95 percent chance that the comet will land in the ZOPI. Multiply the value you calculated in by 95. This gives you the percentage probability of base destruction.

c) Record the probability in column E.

d) Give this information to member 7.

### Explanation of Probability

Probability is the chance of an event occurring. It is the ratio of the number of times something actually happens to the number of times it could happen.

Example: The area of the ZOPI (column C) is 283,000. The area of danger (column D) is 14,000. The probability of destruction is  $14,000/283,000 = 0.049$ . The percent probability is  $0.049 \times 95$ , which is 4.41%. That means there is 4.41% likelihood that the comet will destroy the base.

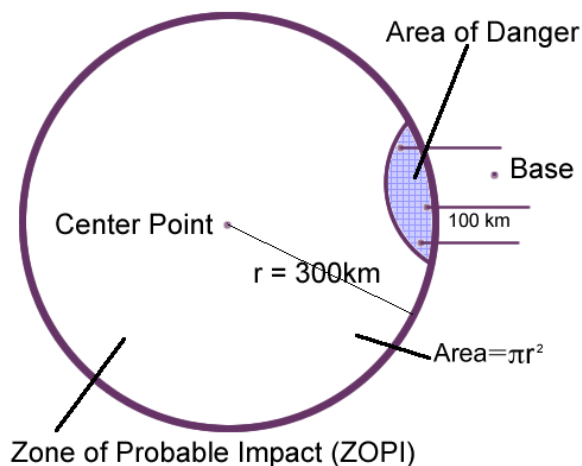
### Explanation of ZOPI and Area of Danger

Look at the diagram below. The large circle is the ZOPI. There is a 95 percent chance that the comet will land somewhere in that circle.

In this example, there is a base to the right of the ZOPI. The comet ejecta can reach 100 km. That means any impact within 100 km of the base would be dangerous.

On the diagram three lines show the distance ejecta could travel. Each line represents 100 km. They start at points of impact within the ZOPI. All three lines reach beyond the base. That means if a comet landed at one of those three points its ejecta would reach the base.

The shaded area is the part of the ZOPI that is within 100 km of the base. Therefore, the base is in danger from the comet's ejecta if the comet lands anywhere in that shaded area. This shaded area is called the area of danger.



### Member 7

After each row on the worksheets is completed, Member 7 should complete two report forms. On each form record the UTC, ZOPI, and probability of base destruction for each base. Give one report form to the Communication Team. Give the other to the Crisis Management Team.