Lesson 13 – Student Worksheet

Outpost Communications Exercise

During your Moon, Mars, and Beyond e-Mission, you will have to read clues to get the information to locate the lost ship and astronauts. You have been learning a lot of information about the planets in our solar system to help you with your important tasks.

This lesson allows you to practice all the skills you have been working on to figure out the location of the Mission Specialist who is writing to you from a Base Camp somewhere in out solar system.

Procedure:

1. **Read** the letters from the Mission Specialists at Base Camps somewhere in our solar system.
2. Using the clues given in their letters, **find out** which planet the writer is visiting and studying and record the planet on your worksheet.
3. You can **use** your Planetary Trading Cards and Planetary Poster for data and information about the planets.
4. **Highlight** the clues that allowed you to make your decision. (Your teacher will check these clues, so highlight ONLY the clues that allowed you to choose the planet.)

Record the location of the Base Camps:

Base Camp Alpha: _____

Base Camp Bravo: _____

Base Camp Charlie: _____

Base Camp Daniel: _____

Base Camp Elephant: _____

Base Camp Freedom: _____

Base Camp Gorilla: _____

Base Camp Hurricane: _____

Letter from Base Camp ALPHA

From: missionspecialist@basecampalpha.gov

To: missioncontrol@basecampearth.gov

Subject: Base Camp Alpha Status Report

Dear Mission Control,

This is Base Camp Alpha reporting on the status of our mission. We had a successful flight with few problems. As we traveled closer to the star at the center of our solar system, we were very thankful for the heat shields that were built on this spacecraft.

We did not have to travel as far as some of the other specialists because we were traveling to an inner planet. The inner planets, which orbit closer to the Sun, tends to be smaller and closer in size. In fact, our planet is the second smallest planet in the solar system and it is only approximately 60 million km or .4 AU from the Sun. Due to the planet's closeness to the sun, the temperature during the daytime can be as high as 427 degrees Celsius (800 degrees Fahrenheit). In contrast, the nighttime temperature dips to lows of -168 degrees C (-270 degrees F).

The big difference in temperature is because there is almost no atmosphere on this planet. We have found some hydrogen and helium, but very little. Because there is no atmosphere, there is no way for the planet to hold in the heat from the Sun. Because the heat escapes and there is no sun at night, it becomes very cold. It is also interesting to point out that a day on our planet lasts nearly 59 earth days and night lasts nearly 29.

Our planet's surface is covered in craters, like Earth's Moon. It is believed the craters were created by volcano eruptions. As I said before, this is a small planet measuring 4880 km (3,031 miles) in diameter. It would take 20 of our planets to equal the mass of Earth.

We will be in contact as we learn more about our planet. Keep us informed on things happening back on Earth!

This is Base Camp Alpha signing off.

Letter from Base Camp BRAVO

From: missionspecialist@basecampbravo.gov

To: missioncontrol@basecampearth.gov

Subject: Base Camp Bravo Status Report

Dear Mission Control,

We are proud to say that Space Craft Bravo has landed on our assigned planet. From this point forward we will be Base Camp Bravo. The flight was much shorter than many of our friends' flights who must travel many kilometers further than we did. Base Camp Bravo is about 41,400,000 km from Earth and 108,000,000 km or 0.7 AU from the sun.

Although we are not on the closest planet to the Sun, we are on the hottest planet. The average temperature at Base Camp Bravo is 457 degrees Celsius or 870 degrees Fahrenheit. The reason the temperatures are so high at Base Camp Bravo is the cloud cover. Cloud cover traps the heat not allowing it to escape; this is called the "greenhouse effect." The clouds that cover Base Camp Bravo are made mostly of sulfuric acid and the air is made mostly of carbon dioxide. As you know, these are very dangerous gases and several changes had to be made so that we could live and study on this planet.

Although the size of our planet is very close to the size of Earth, about 12,103 km (7,521 miles), it rotates at a much slower speed. Each day at Base Camp Bravo is roughly 243 Earth days. This planet will revolve around the sun in 224.7 Earth days. A year here is actually shorter than a day! It may also interest Mission Control to know that this planet rotates in the opposite direction of Earth.

Mission Control should not expect any feedback or studies on the moons of Base Camp Bravo because we have no moons. This is not uncommon on the inner planets. We do look forward, however, to sharing with you everything we learn during our stay at Base Camp Bravo.

This is Base Camp Bravo signing off.

Letter from Base Camp CHARLIE

From: missionspecialist@basecampcharlie.gov

To: missioncontrol@basecampearth.gov

Subject: Base Camp Charlie Status Report

Dear Mission Control,

This is Base Camp Charlie reporting that we have landed and set up camp. Our trip went well and was not too long. We are worried that we may need more oxygen because our planet has none. The thin atmosphere on this planet is made mostly of carbon dioxide with small amounts of nitrogen and argon.

The surface of this planet is very rocky. We think the surface is made of rich basaltic, igneous rock. The thin crust of this planet is similar to Earth's crust. We think that water once flowed here. We have seen what may be dried up channels, rivers, and lakes. It is very exciting to see this. We also believe that most of the water on this planet is now stored in the polar ice caps and the layer of permafrost that covers much of the planet.

The temperature here at Base Camp Charlie is colder than on Earth because we are further from the Sun. We are about 228 million km from the Sun, which is about 75.1 million km further than Earth. The average high temperature can get as warm as 20 degrees C (68 degrees F) and as cold as -140 degrees C (-220 degrees F).

The length of the day is nearly the same as on Earth. One day lasts about 24.6 hours. This has been very helpful to us as we get use to life at Base Camp Charlie. The year, however, is a bit longer than it is on Earth. It takes this planet 686 Earth days to make one revolution around the Sun.

Although this planet is small, about half the size of Earth, there is much to learn about it. We look forward to studying the volcano which may be the largest one in the solar system, the two tiny moons that orbit the planet, and much more.

This is Base Camp Charlie signing off.

Letter from Base Camp DANIEL

From: missionspecialist@basecampdaniel.gov

To: missioncontrol@basecampearth.gov

Subject: Base Camp Daniel Status Report

Dear Mission Control,

This is Base Camp Daniel reporting on our progress. We have made it to the outer planets. Our travel through the asteroid belt was difficult. Although it is hard to see from far away, our planet has a faint ring made of small rock bits and dust.

The planet is so large, nearly 11 times bigger than Earth. It will take years to study. We estimate the diameter to be around 142,000 km (88,700 miles). Although it will take time to learn about this planet, we have begun collecting some data we want to share with you.

Because the planet is made mostly of gas, we have decided to set base camp on one of its 4 large moons. There are dozens of smaller moons which also revolve around this planet. (We have counted 63 so far!) We have decided to set camp on the largest of the moons, which may be the largest moon in the solar system.

We have found that a day on this planet is very short. This planet revolves so quickly that a day lasts only 9.8 Earth hours. A year is much longer. Because this planet is located on average 778,330,000 km (480,000,000 miles) from the Sun, it takes over 12 Earth years to revolve around the Sun once. This also causes the planet's cold temperatures. The average temperature is around -153 degrees C (-244 degrees F). We have also noticed there is a slight tilt on the axis which means this planet does not experience seasons.

There is a great deal to learn about our new home. We are really looking forward to studying the large storm that covers part of this planet. We will report back to you when we have more information.

This is Base Camp Daniel signing off.

Letter from Base Camp ELEPHANT

From: missionspecialist@basecampelephant.gov

To: missioncontrol@basecampearth.gov

Subject: Base Camp Elephant Status Report

Dear Mission Control,

This is Base Camp Elephant reporting. We had quite a trip through the asteroid belt. Our pilot did a great job making sure we arrived safely. It was interesting to see other planets as we made our way to camp. The most exciting part was getting the chance to fly past the largest planet in our solar system! You cannot imagine its size until you have the chance to fly past it.

After traveling 9.5 AU, we got to our home planet ready to set up base camp. The first problem we had to overcome was the rings surrounding our planet. The rings are made up of chunks of ice and some rock. We saw some chunks that were very small, like the length of a fingernail, and we saw some that were quite large, like the size of a car.

We knew we had to consider a few things before setting up. First, we needed to consider the atmosphere and gravity. The atmosphere at Base Camp Elephant is very gaseous, made up mostly of hydrogen and helium. This meant we would need to have a lot of oxygen and find a way to recycle it. There is gravity on our planet and it is close to the gravity on Earth. The gravitational pull is only 1.08 times the gravity on Earth.

Another problem we needed to consider was temperature. Because we are about 1.3 billion km from the Sun, the average temperature is rather cold. The average temperature runs about -180 degrees C (-290 degrees F). Think about that the next time you complain about the cold on Earth! Several changes needed to be made to keep our bodies and spacecraft warm.

We have begun doing some exploration and studying from Base Camp Elephant. We have very little daylight because a day is only 10.2 hours long. We plan to continue our studies on Base Camp Elephant for one year. Because this is almost 30 Earth years, a few replacement groups will be needed to come here and take over for the specialists who have been here awhile.

As we stare out at the second largest moon in our solar system, we are reminded of the great chance we have been given. We will be in touch as we learn more about our planet.

This is Base Camp Elephant signing off.

Letter from Base Camp FREEDOM

From: missionspecialist@basecampfreedom.gov

To: missioncontrol@basecampearth.gov

Subject: Base Camp Freedom Status Report

Dear Mission Control,

This is an amazing planet! There are so many strange features we can not wait to share with you. Before we begin telling you about our new home, you should know our flight went very well, although the trip was quite long. This planet is about 19.2 AU from the Sun which is over 19 times further from the Sun than Earth.

The planet is made mostly of frozen gas. The most plentiful gas is hydrogen followed by helium and methane. The methane in the atmosphere is what gives this planet its bright blue color. The gases in the atmosphere are frozen because of the icy cold temperatures. The average temperature here is -197 degrees C. Now that is cold! The distance from the Sun is what causes this low temperature.

Another interesting feature on this planet is the rotation. Most planets spin on an axis which has a small tilt. This planet, however, spins on an axis which has a very large tilt. This tilt makes the planet rotate on its side. This sideways rotation gives the planet very extreme seasons. Each season will last about 21 Earth years. For 21 years there will be complete darkness, 21 years of complete daylight, and 42 years of equal day and night. As you can see by the length of each season, one year here lasts about 84 Earth years. In contrast, a day here is somewhat shorter than a day on Earth. One day will last slightly less than 18 hours.

Like many of the outer planets, this planet has rings that go around it. There are 11 faint rings made up of dust and rock. Another feature that this planet shares with the other outer planets is its many moons. So far we have counted 5 major moons and 22 smaller moons. We actually found two of the moons in the outer rings.

We will have a large area to explore and discover. This planet is about 4 times bigger than Earth. It measures 51,118 km (31,690 miles) in diameter making it the third largest planet in our solar system. We are looking forward to learning as much as we can.

This is Base Camp Freedom signing off.

Letter from Base Camp GORILLA

From: missionspecialist@basecampgorilla.gov

To: missioncontrol@basecampearth.gov

Subject: Base Camp Gorilla Status Report

Dear Mission Control,

This is Base Camp Gorilla proudly reporting. We have had a very long trip. Did you know this planet is just over 30 AU from the Sun? This is 30 times as far as the Earth is from the Sun.

This far distance should tell you we are on an outer planet. This planet is made up of gas like the other outer planets. The atmosphere is made mostly of hydrogen and some helium and methane. Like our neighboring planet, the methane gives this planet its blue color. The hazy atmosphere also makes strong winds, the strongest in the solar system. A dark spot on the planet has proven to be a hurricane the size of Earth. We have measured wind speeds as high as 2,400 km/h (1,500 mph).

Faint rings surround the planet. Because you can not see this planet with the naked eye, you would need a strong telescope to detect these light rings. Also, orbiting around this planet are 13 moons. One moon, Triton, is rotating in the opposite direction of the planet. We know of no other moon doing this.

This planet rotates on an axis that is tilted just slightly more than Earth. This tilt gives the planet 4 seasons. Each season lasts about 40 years. During this time, each pole will have a season with complete darkness and a season of total daylight. It takes this planet 164 Earth years to revolve around the Sun and about 19 hours to rotate on its axis.

As this planet travels around the Sun, it crosses orbit with another planet. This crossing causes a change of positions in the planets for a period of 20 years every 248 years. In September of the year 2226, this planet will be the furthest planet from the Sun.

There is so much to study and learn about this planet. We look forward to reporting back to you with new information

This is Base Camp Gorilla signing off.

Letter from Base Camp HURRICANE

From: missionspecialist@basecamphurricane.gov

To: missioncontrol@basecampearth.gov

Subject: Base Camp Hurricane Status Report

Dear Mission Control,

After many years of traveling we have finally made it to our base planet. We are the first spacecraft to make it this far into the solar system. We have not done any exploration yet, but we can report a few of our findings.

This planet differs from the other outer planets in a few ways. First, while most outer planets are very large, this planet only measures 2,274 km (1,413 miles). This is 1/5 the size of Earth. The other outer planets have many moons, but this planet only has 3 moons. Also, this planet appears to be covered with frost.

Although it shares most characteristics with the inner planets, there are a few things it shares with the outer planets. First are the cold temperatures. The average distance is 39.53 AU or 5,900 million km (3,666 million miles). Because the planet is so far away from the Sun, its average temperature is -233 degrees C (-393 degrees F).

Another characteristic it shares with the outer planets is the long length of its year. Since the outer planets are so far from the Sun, it takes them longer to travel one time around it. The revolution around the Sun takes this planet almost 248 Earth years.

This planet does have something that is all its own – its orbit. The other 8 planets travel around the Sun in a mostly circular orbit. This planet's orbit, however, is much more of an oval. Its orbit actually crosses paths with another planet. During a 20 year period, this planet is not the furthest from the Sun! This will not happen again until the year 2226.

There is little known about this planet, so we have a lot to do. As we learn more, we will contact you. Until then,

This is Base Camp Hurricane signing off.