**Survivor Case Study: Instructor Guide (D. Duncan and B. Ingermann)**

**Notes to Operator**

Keep clock in DS running in Boulder time zone

**Materials**

* Small white boards and markers for students to work on - one per group
* Several globes **[TAs must bring these to Fiske from SBO]**
* Bring some red flashlights

**Facilitation Method**

* Students will form groups of 2-4.
* Hand out the overall goal (The student file is called “ASTR 1010 Survivor”): “Based on observations of the sky (for no more than one month forward and backward in time) your goal is to determine where you are on Earth (latitude, longitude) and the **approximate** time of year it is. Within your groups, your job is to brainstorm observations you could make to help you answer these questions (keep in mind, it might take multiple questions or observations to start understanding where and when you are located).”
* Before leaving Boulder, give students the option to observe the Boulder sky for 24 hrs. *Make sure to have them brainstorm in their groups first about what sorts of things they should look for during this time*. **[They should observe the times of sunrise and sunset, and maybe noon, but don’t *tell* them what to do.]**
* Emphasize that we’ll start with a question or observation the groups would like to make. Each group should brainstorm and write down the top 1 or 2 questions you would like to ask (This is probably in the form of an observation) and *how that question or observation might be useful*.
* After collecting the top questions, the operator will demonstrate using the dome, then prompt students for the next question or observation they would like to make.
* When students write questions, facilitate to make sure they request a specific observation they would like to make and why they think that observation might be useful.
* Encourage students to draw diagrams.
* Emphasize that there may be multiple ways to find the answer to the same problem.

**Given**

* Students allowed 1 month forward and backward in time
* Time of sunset in Boulder is observed for the day they arrive, watch is synced to Boulder time (\*\*\*Be careful that this is adjusted for daylight savings time)

**Investigation Pathways**

1. Latitude

Goal: use altitude of north star (altitude = latitude)

Essential questions:

* Where is the north star? (*Facilitation*: *how we can find the north star via observations?*)
  + Can we progress time to track star motions? [Display star trails]
* What is the angle of the north star in the sky / what is the north star’s altitude above the horizon? [remind students how to use hands to estimate degrees]

1. Longitude

Goal: Compare absolute times, 1 hr = 15 degrees of longitude (360 degrees / 24 hrs)

Essential questions:

* What time is it in Boulder when the sun sets at our current location? **[Operator and TAs – we only know Boulder time; the time zone of where we put the students is an unknown. They have to figure out their longitude.]**
* How does this compare to the time the sun sets in Boulder?

Other possible routes:

* How does the sunset time in our location compare to sunset time in Boulder? (*Facilitation*: *how can we find the time of sunset in our current location? What’s a time that we know? (noon) How can we use this to observe what time it is at sunset?*)
* How far across the sky does the sun move in 1 hr? (*Facilitation*: *How far across the sky does the sun move in 24 hours?*)
  + - [use hands as angle calculators to estimate sunset]
  + Note a bright star that is on the meridian at midnight

Other questions:

* What time is it on the prime meridian or elsewhere? [Students not given this information, unless they deduce it from sunset time in Boulder]
* What time is it currently where we are? [Students must deduce this information]

1. Time of year

Goal: Sun rising location and/or maximum altitude can determine time of year

Essential questions:

* Does the sun rise due east, north of east, or south of east? (*Facilitation: without a compass, how could we determine cardinal points?*)
  + Indicates time of year relative to equinoxes
* Over the course of a month, does the sun get lower or higher in the sky? [Sun’s motion forward and backward in time]
  + Indicates time of year relative to solstices

Other questions:

* What constellations are associated with different times of the year?
* What maximum altitude does the sun reach on day 1?
  + Sun altitude range = 90 - latitude +/- 23.5 degree

**Note to Navigator:**

**Do NOT change the date when you move to the “unknown” part of the earth**

**Briana Ingermann, Fiske Education Manger, has a list of good places to drop students:**

1. **Hawaii**
2. **Washington DC (Same latitude as Colorado, but two time zones away)**
3. **Japan**
4. **Philippines**
5. **Spain**
6. **Kazakhstan (12 hours away from Colorado; our sister city is there!)**

Here is a list of locations we've done in the past that were successful:

Barcelona, Spain | Lat 41 N, Long 2 E | Sept 22

Tokyo, Japan | Lat 36 N, Long 140 E | Mar 23

Panama City, Panama | Lat 9 N, Long 80 W | Dec 1

Dominican Republic| Lat 18 N, Long 70 W | Aug 20, 2017

Honolulu, HI| Lat 21 N, Long 158 W | Aug 20, 2017

Fairbanks, AK | Lat 65 N, Long 148 W | Sept 20

We've also done Washington DC, but I get the sense that students find that one less interesting because the sky doesn't change at all and the time is very similar.

Also, I've attached a version of the map that is a full page so that students can read it more easily. If you use the locations above, it sometimes is useful to alert students that the location they are in might not be in one of the cities on the map.