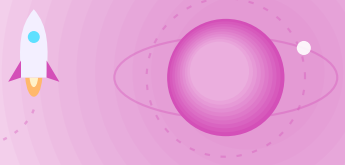
LESSON C-01 · CAPSTONE MISSIONS

Observatory Builder

HIGH SCHOOL (9–12)



Name _____ Date _____ Class / Period _____

Build an observatory

A space observatory is only useful if it keeps its power through every orbit, including the dark half-hour in the planet's shadow. In this mission you check the power, fly to a station module, dock with it, and check the power, heat and strength of the combined craft.

Mission goal: dock with the station module and show that the observatory rides through the eclipse ({eclipseMin} minutes, {needKj} kJ) within its heat and strength limits.

1 LOOK

OBSERVE BEFORE YOU TOUCH A CONTROL

Step 1 · Power through the dark

- Our tug circles Terra _____ km up. One lap takes _____ minutes, and _____ of them are in Terra's shadow.
- The observatory needs _____ W all the time. Two solar panels make _____ kW in sunlight and nothing in shadow. They are folded away right now.

Step 2 · Come alongside

- The station module is _____ m ahead of us on the same orbit, nose pointing back at us. It is already selected as your target.
- Our battery alone is not enough, but the station module brings another one when we dock. We have _____ kg of RCS fuel.

Step 3 · Dock and check

- The ports latch when they are closer than _____ m and lined up to within _____°, closing gently.
- When they join, the batteries of both tugs belong to the observatory.

Write the numbers shown in the sim in the blanks above, then record what you notice:

2 PREDICT

COMMIT TO A HYPOTHESIS FIRST

Prediction 1. During the eclipse, when the craft is in Terra's shadow, what powers the station?

Hint: An eclipse is the time spent in a planet's shadow, where sunlight cannot reach the solar panels.

□ The solar panels, which still produce power in the dark

□ Batteries charged in sunlight

Because...

Prediction 2. In the last 20 metres before the ports touch, what is the safest way to close in?

Hint: Bumping into a spacecraft can damage it or bounce it away.

□ Fast, then brake at the last moment

□ Slow and steady, lined up with the port

Because...

Prediction 3. The station module has a battery of its own. After you dock with it, what happens to the power margin?

Hint: The margin compares the energy stored in the batteries with the energy the station needs in the dark.

□ It stays the same

□ It goes down

□ It goes up: there are more batteries

Because...

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3 EXPERIMENT

CHANGE ONE VARIABLE AT A TIME

Step 1. Press the Extend Solar Panels button in the flight HUD (the panel icon) to open the panels. The bar is full once the Power margin is 0.5 or more.

Step 2. Press **[R]** for RCS. In the Flight Computer open the DOCKING tab and press ALIGN PORT. Tap **[I]** for about _____ seconds to start closing at about _____ m/s. If you drift sideways press NULL REL VEL. Close in until the Port distance is under 20 m.

Step 3. Keep closing slowly with **[I]**; tap **[K]** to slow down. Use HOLD CORRIDOR in the Flight Computer to stay on the line. When the ports touch they latch.

Trial	What I changed	What I measured / saw	Matched my prediction?
1			Yes · No · Partly
2			Yes · No · Partly
3			Yes · No · Partly

4 EXPLAIN

CLAIM · EVIDENCE · REASONING

Claim – What did you find out? (answer the mission goal in one sentence)

Evidence — Which numbers or observations from the sim support your claim?

Reasoning — Which science idea connects your evidence to your claim?

Self-check: □ I made a prediction before experimenting □ I used numbers from the sim □ I explained *why*, not just *what*