[2B Presentation.pdf]

1. **Purpose of mission**

One might send a probe to mercury in order to take measurements of various physical characteristics. Previous missions to Mercury such as MESSENGER have explored:

1.1. Why a mission to Mercury

To answer six broad scientific questions:
Why is Mercury so dense?
What is the geologic history of Mercury?
What is the nature of Mercury's magnetic field?
What is the structure of Mercury's core?
What are the unusual materials at Mercury's poles?
What volatiles are important at Mercury?

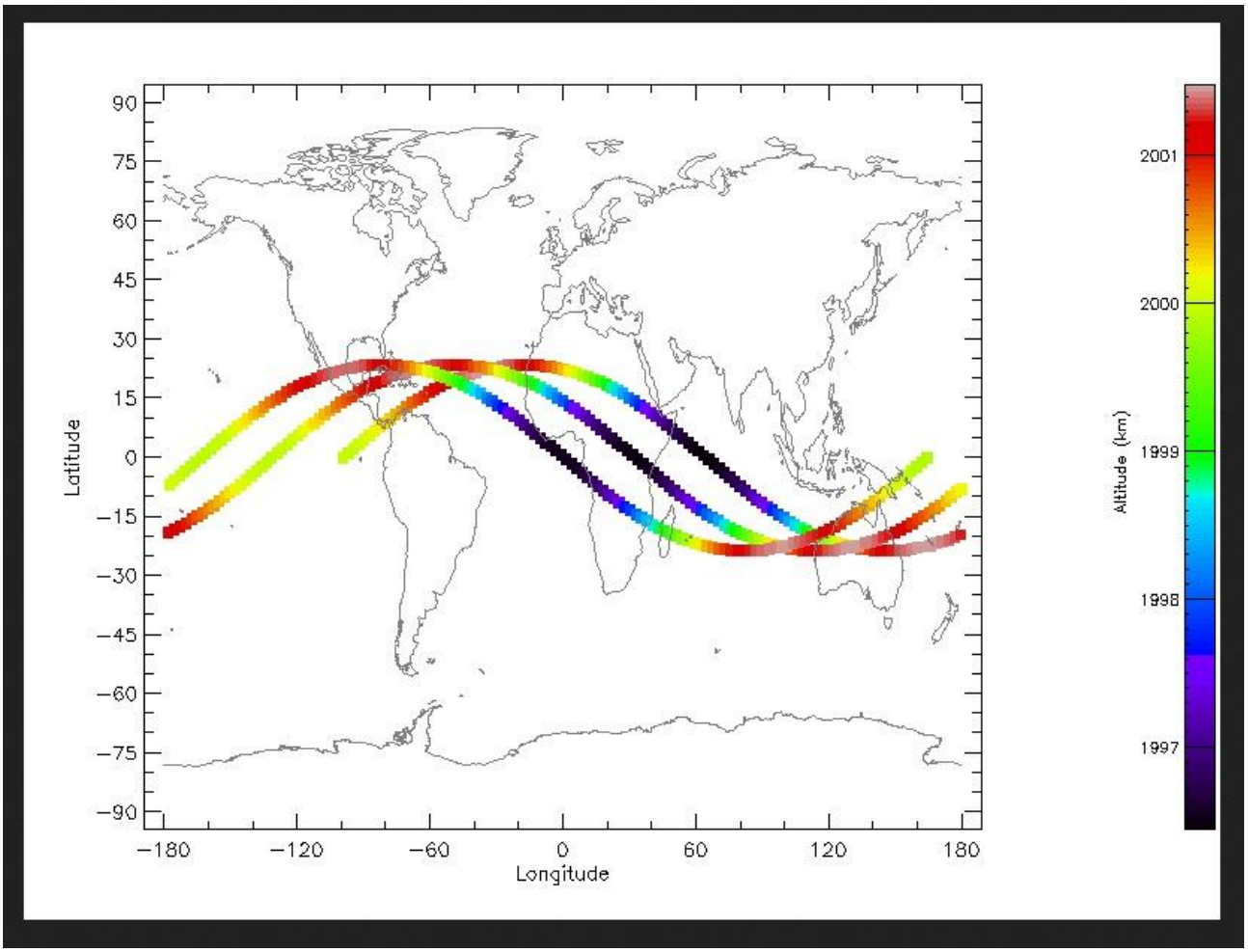
Understanding Mercury, and the forces that have shaped it, is fundamental to understanding the terrestrial planets and their evolution.

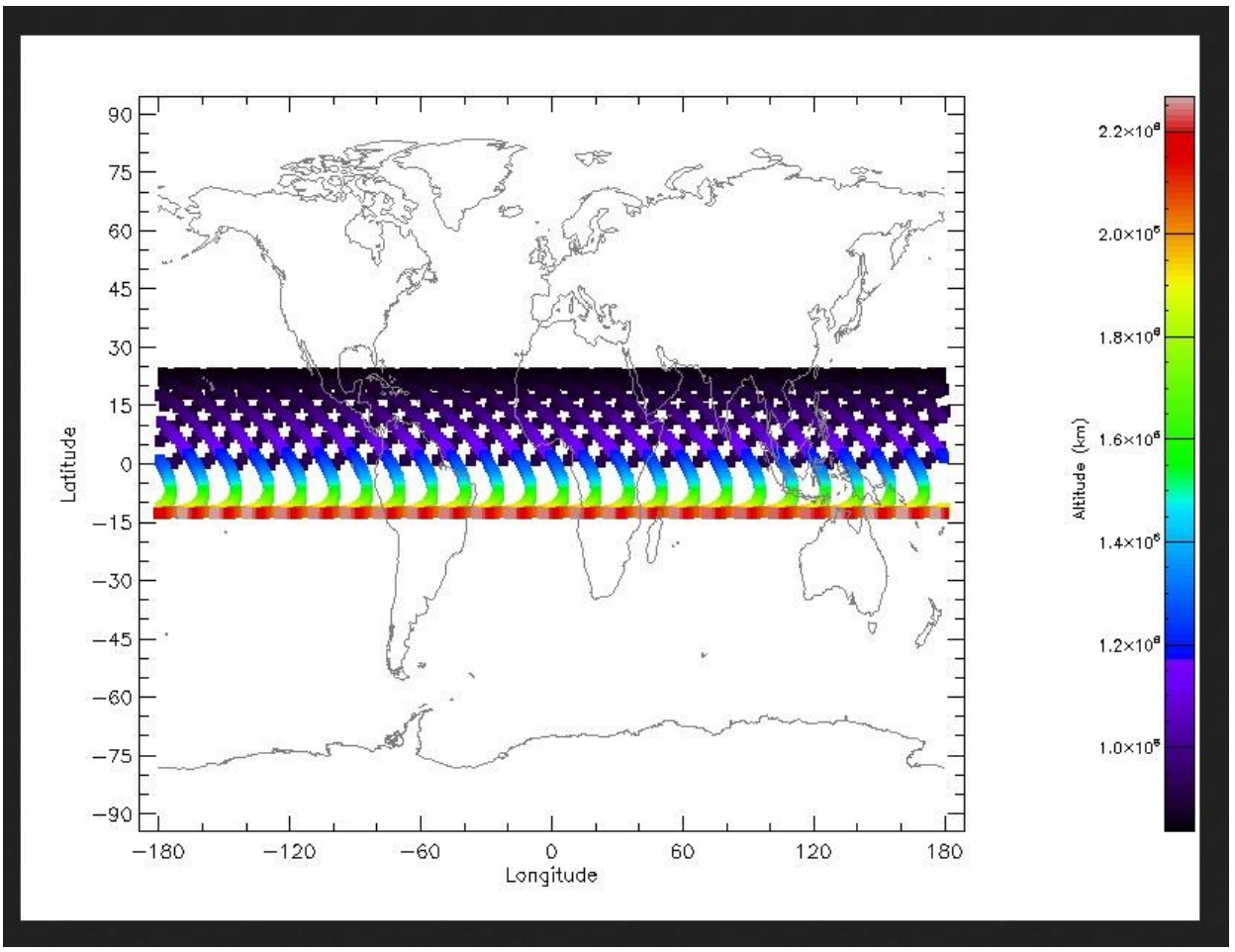
2. **What kinds of orbits & maneuvers are needed?**

Initial calculation: Launching from Cape Canaveral, because of the high rotational speed (closer to Equator with Vcc = 406 m/s). Also, compensating with earth's inclination of 23.5 with the inclination, to a circular orbit at a height of 2000Km from the earth surface. Furthermore, from the orbit, to escape the sphere of influence (at 920000 km), a Hohmann maneuver is chosen till Mercury's orbit.

Assumptions: horizontal launch, tangential to Earth's surface, with an inclination that compensates for the axial tilt of the earth (ie. ~23.5 deg). We also ignore the effects of the atmosphere. Additionally, we assume that the planetary orbits are circular.

3. Ground Track Sketch





4. **Propulsion methods? DeltaV?**

For the propulsion, we choose liquid fuel rockets due to the large ΔV involved in the transfer maneuver.

The ΔV of the Hohmann maneuver is relatively high: -17.15 km/s.
Once the spacecraft is free of the gravitational influence of Earth, it will be travelling around the Sun at Earth's velocity (Vearth = 29.8 km/s). It must perform a burn ΔV1 = -7.53 km/s which puts it on an intercept course with Mercury at the perihelion (assuming that, in fact, Mercury happens to be at that position).

Once the spacecraft reaches Mercury, it will have accelerated significantly (Vp = 57.5 km/s). The spacecraft must then perform a second burn to match Mercury's orbital velocity (Vmerc = 47.88 km/s). This is ΔV2 = -9.61 km/s.

Using Kepler's third law, we can observe that the maneuver takes ~105 days.