**Testing Plan**

**Purpose:**

The point of this testing plan is to see if the AI can really support Mars mission planning in a way that makes sense. It has to give suggestions that are not only helpful but also safe enough for NASA’s standards during an actual mission. The testing process is meant to show how well the AI can handle all the challenges that come with planning a day on Mars, like tricky terrain, changing weather, and limited power. By testing the system in a simulated Mars environment, we can figure out how reliable it is, how fast it works, and whether engineers feel comfortable using it. This step is important because it shows whether the AI is just a good idea or something that can really work. It’s not just about seeing if the AI can make a plan, but also about making sure that plan makes sense, avoids danger, and helps the mission succeed. Testing also gives us a chance to see where the system needs improvement before it ever gets near a real rover.

**Simulated Testing Environment:**

The object is to run tests in a digital Mars setup that mirrors actual conditions. That means using realistic terrain, rover features, and mission goals. I came up with this after checking out some hands-on activities at Space Center Houston that show how NASA works through its mission plans.I read several Medium articles explaining how NASA tests AI tools, including drone flights and rover planning, which helped shape this testing plan. I also learned from Medium case studies on how NASA tests AI like guiding helicopters and planning rover routes. Those examples helped shape how I designed this testing plan.

**Testing Phases:**

**Unit Testing:** Individual components like the terrain analyzer and energy forecast engine are tested separately to ensure they perform expected functions.

**Integration Testing:** All modules are connected and tested together to ensure the system shares and processes data correctly.

**Human-in-the-Loop Feedback:** NASA engineers will use simulated data to try out the system and share feedback on how easy it is to use and how much they trust its suggestions.

**Stress Testing:** The AI will be tested in tough situations like missing information, power loss, or sudden changes in the landscape to see how well it can handle problems.

**Success Criteria:**

**Accurate, safe plans:** Routes and schedules should avoid risk and align with mission goals.

**Faster planning time:** Compared to current manual planning processes.

**High engineer confidence:** It’s important that NASA engineers believe in the system enough to actually use it during planning.

**Adaptability to edge cases:** The system has to stay reliable, even when conditions on Mars take an unexpected turn.

**Post-Test Improvements:**

**Enhanced training data:**

After the tests are done we can give the system more examples with different problems so it keeps getting better at spotting risky situations later on.

**Improved explanation features:**

The system should be updated to explain its choices in a way that’s easy for people to understand, so they don’t waste time trying to figure out why it picked something.

**Better energy usage predictions:**

Refine how the system models power usage.

**More intuitive controls:** Simplify how users adjust AI recommendations and interact with the interface.