**Feedback and Suggestions on Project Proposal**

Your project summary is off to a solid start—it's clear, methodical, and includes technical components.

**General Feedback**

**Strengths**

* **Clear Scope:** The project identifies the objective well—evaluating station-keeping with different propellants in two orbital regimes.
* **Well-Structured Format:** The proposed structure is logical and will guide the reader through your methodology, analysis, and conclusions.
* **Realistic Assumptions:** Including drag, J2, and SRP is good; these are critical forces for LEO CubeSats. Assuming idealized ISP values and instantaneous burns is also appropriate for a trade study.

**Suggestions/Possibilities (Doesn’t Have to Be Incorporated, Ideas Only)**

**1. Could Clarify the Orbit Parameters**

* Define the orbital parameters (e.g., altitude, inclination) of the circular and elliptical orbits. For example:
  + Circular: 500 km altitude, 51.6° inclination (ISS-like)
  + Elliptical: 300 km perigee, 1000 km apogee

**2. Extra Justification for Propellant Selection**

* Consider adding a rationale for selecting **hydrogen peroxide, monomethylhydrazine, and isobutane**. For example:
  + Availability and maturity for CubeSats
  + Safety/handling constraints
  + Typical ISP and thrust values

**3. Distinguish Between Propulsion Technologies**

* The **propulsion system architecture** (e.g., cold gas vs. chemical vs. electric) will have a major effect on Delta-V, control authority, and mass. Even small systems like **Iodine-fueled Hall-effect thrusters** might offer better performance than cold gas for some missions—this could be a useful point of discussion.

**4. Quantify Initial Conditions**

* How much ΔV will each system start with? Include estimates based on tank size/mass fraction or link to typical mission profiles (e.g., from [NASA CubeSat Design Specification](https://www.nasa.gov/sites/default/files/atoms/files/cubesat_design_specification_rev13_final2.pdf)).

**5. Include Power Budget Considerations**

* Some propulsion systems (like electric) might not be viable if power is limited. Even if you're not testing electric propulsion, a brief discussion of power constraints could strengthen the realism of your analysis.

**6. Python Simulation Details**

* The plan to use the SGP4 model is sound for propagating orbits, but note that SGP4 does not inherently model drag decay or apply maneuvers—it models TLE-based orbits. You may want to consider using a numerical integrator (like Runge-Kutta).
* Alternatively, describe how SGP4 is adapted to reflect dynamic station-keeping logic.

**Suggested Academic References & Resources**

**Station-Keeping and CubeSat Maneuvering**

* **Jeongrae Kim & Daniel Selva, "Optimal Station-Keeping Strategies for CubeSats in LEO with Propulsion Constraints,"** *Acta Astronautica, 2020.*
* **P. Klesh, A. K. L. Wong, J. Puig-Suari, "Propulsion System Options for CubeSats,"** *Small Satellite Conference, 2010.*
* **Adrian Stoica et al., “Low-Thrust Orbit Maintenance for CubeSat Constellations,”** *IEEE Aerospace Conference, 2022.*
  + Good for insights into ΔV optimization strategies

**Propulsion Systems and Trade Studies**

* **Nathan J. Strange et al., "Evaluation of Propulsion Options for Small Satellites,"** *NASA Jet Propulsion Lab Technical Report, 2014.*
  + Focuses on performance/mass tradeoffs of various small-scale systems.
* **Jason A. Budinoff, “Development of a Green Propellant Monopropulsion System for Small Spacecraft,”** *AIAA 2013-3834.*
  + Discusses hydrogen peroxide systems in detail.

**Summary of Actionable Suggestions**

| **Area** | **Suggestion** |
| --- | --- |
| Orbit Definition | Specify orbital altitudes, inclinations, and eccentricities |
| Propellant Choice | Justify with ISP, safety, maturity, and volume efficiency |
| Simulation Model | Clarify SGP4 usage and if maneuvers are simulated independently |
| Propulsion Systems | Include architecture, not just propellant type |
| References | Integrate academic studies on station-keeping and CubeSat propulsion |
| Future Scope | Consider adding electric or hybrid propulsion as future research direction |

**Final Grade: 17 / 20**

| **Criteria** | **Score** |
| --- | --- |
| Overview of General Topic (10 pts) | 8.5 |
| Outline of Plan/Procedure/Format (5 pts) | 4.5 |
| Understanding of Outcome and Goal (5 pts) | 4.0 |
| **Total** | **17** |

1. **Overview of the General Topic (10 points)**
   * You’ve established a clear and technically sound context for the study, focusing on CubeSat station-keeping, orbital dynamics, and propellant evaluation. The overview could be stronger with more background on **why station-keeping is a challenge for CubeSats**, current mission examples, and common failure modes.
2. **Outline of Plan/Procedure/Format (5 points)**
   * The plan is outlined well with logical formatting. The structure (introduction → background → methodology → analysis → conclusion) is solid. One suggestion: briefly describe what each simulation case is meant to test or demonstrate—i.e., not just listing the matrix, but what insights you expect from each variation.
3. **Understanding of General Outcome and Clear Designation of Project Goal (5 points)**
   * The goal is well stated: evaluate station-keeping capability and determine optimal propellants. Consider elaborating how this work contributes to scalability, miniaturization tradeoffs, or the viability of long-duration CubeSat missions.