Aero Engineers: Designing for Optimal Flight

Grade Level: 4th - 5th Grade

Objective:

- Students will apply the principles of aerodynamics to design and modify paper airplanes.
- Students will engage in the engineering design process by planning, building, testing, and optimizing their airplane designs to meet specific flight challenges.
- Students will understand and apply modifications to explore how changes in airplane design affect flight.

Standards:

- **NGSS 4-PS3-4:** Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- **NGSS 5-PS2-1:** Support an argument that the gravitational force exerted by Earth on objects is directed down.

Materials:

- Paper (various types)
- Markers for decorating
- Rulers
- Scissors
- Paper Clips or tape for adjustments

Procedure:

1. **Introduction to Aerodynamics (10 minutes):** Review the concepts of lift, drag, thrust, and gravity, emphasizing their relevance to aircraft design.
2. **Design Challenge Introduction (5 minutes):** Present the specific flight challenges (e.g., longest flight, most accurate, best stunt).
3. **Initial Design and Build (20 minutes):** Students analyze the different designs and choose one to build their initial paper airplane, considering the basic aerodynamic principles just learned. Website with instructions to fold different paper airplanes
4. **First Test Flight (10 minutes):** Students test their planes and record the results.

5. **Modifications (15 minutes):** Introduce potential modifications as outlined previously.
6. **Optimization and Re-testing (15 minutes):** Students apply modifications and test their planes again, observing the effects of their changes.
7. **Presentation and Discussion (10 minutes):** Each student or group presents their design process and results, discussing what modifications were most effective.
8. **Conclusion (5 minutes):** Recap key learnings and discuss how these principles apply to real-world aerospace engineering.

Assessment:

- **Performance Tasks:** Evaluate students based on the performance of their designed planes according to the specified challenges.
- **Design Logbooks:** Students keep a logbook where they record their design process, changes made, and results observed, reflecting on what worked and what didn't.

Extensions:

- **Computer Simulation:** Use software to simulate airplane flight. This website is a flight simulator with a global environment generated from satellite images and digital geographic data: GEO-FS Tutorial video on how to use this website: GEO-FS Beginner's Guide Tutorial
- **Career Exploration:** Invite an aerospace engineer to speak to the class, either in person or via a virtual meeting, to discuss their career and the real-world applications of aerodynamics.