



# What Paper Airplane Flies the Farthest?



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## Abstract:

Without the study of aerodynamics, airplanes cannot stay in the air, let alone make safe take-offs and landings. Science has come far enough to understand that the shape of an airplane is important for creating optimal aerodynamics. Our group's research project focuses on paper airplanes and studying which airplane shape enables the plane to fly further. We utilized paper airplanes of varying common models flown in an enclosed space to study the effect of paper folding techniques and other parameters on the distance flown by the planes. The conclusion of this project will not only provide a design that helps a paper airplane fly far with stability, but it will also supply information on what a real airplane should have to achieve better aerodynamics.

## Introduction

In this research project, we set out to test the flight distances of different paper airplanes. Our goal was to explore how the shape of a paper airplane can impact the distance it can fly. By using standard printer paper for each design and conducting our tests in an enclosed place with little air movement, we were able to eliminate some of the variables that could impact our results. The plane designs were collected from a Choose Ohio First cohort meeting where students made paper airplanes using printer paper. We also added three Guinness World Record paper airplane designs. Our testing was done with eight total airplane designs. Through this research, we hope to gain a better understanding of aerodynamics.

## Methods

- Most of the paper airplanes were collected from the Choose Ohio First cohort meeting.
- Rosalie and Lewis threw the planes.
- A measuring tape was used to measure the distance.
- Distances were based on initial ground landing, with a  $\pm 6$ in. due to plane size.



Figure 1: Choose Ohio First Cohort Folding Airplanes

## How an airplane flies

- Forces on a plane: lift, thrust, drag, weight (due to gravity)
- Coanda effect - air flow causes a downward push on the back of the plane wing, lifting the plane up

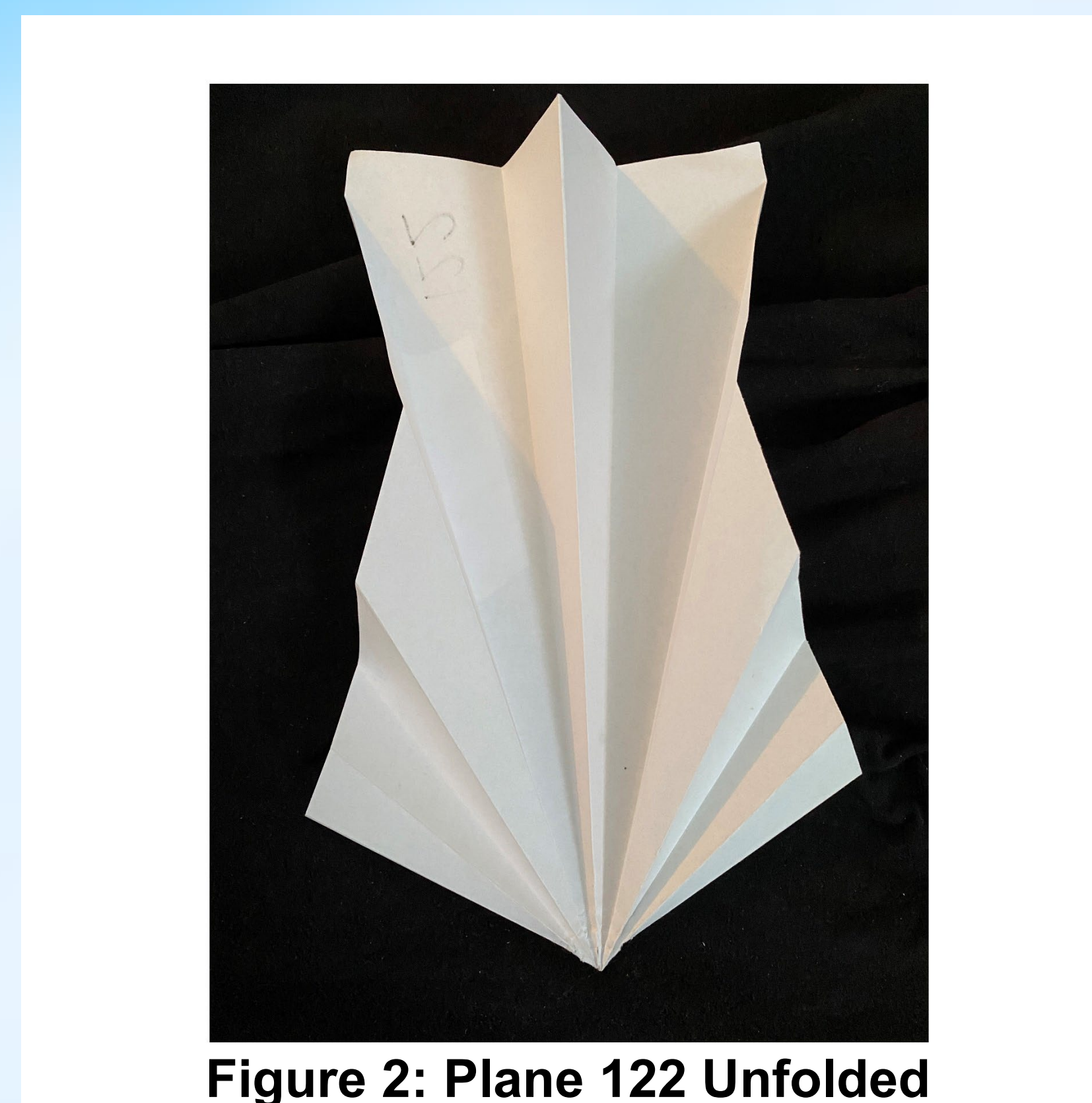


Figure 2: Plane 122 Unfolded



Figure 5: Our paper airplanes

## Results

- Top flights (above 20ft): Tiffany #1, 122, and Tiffany #3
  - Tiffany #1 – smaller wing length
  - 122 & Tiffany #3 – longer wing lengths
- Worst flights (below 18ft): Blue, and Dof

## Errors

- How the plane landed, and where it exactly it landed
- Differences in throwing

## Conclusion

The main factors that contribute to the distance traveled is the thrust that each member exhibits on the plane when thrown and the shape of the plane as it goes through the air. Based on the average paper airplane distances in figure 3, planes 122 and Tiffany #1 flew almost the same distance. Despite the results, we think that a dart-shaped plane should fly farther since it can sustain more thrust. Long, narrow wings on real-life airplanes reduces drag and enables it to fly longer.

## References

- Aerodynamics Explained by a World Record Paper Airplane Designer | Level Up | WIRED
- The Guinness Book of World Records. Stamford, CT: Guinness Media, 1996 1997.
- Wing Aspect Ratio – Science Learning Hub

## Acknowledgments

- Society of Physics Students
- Choose Ohio First

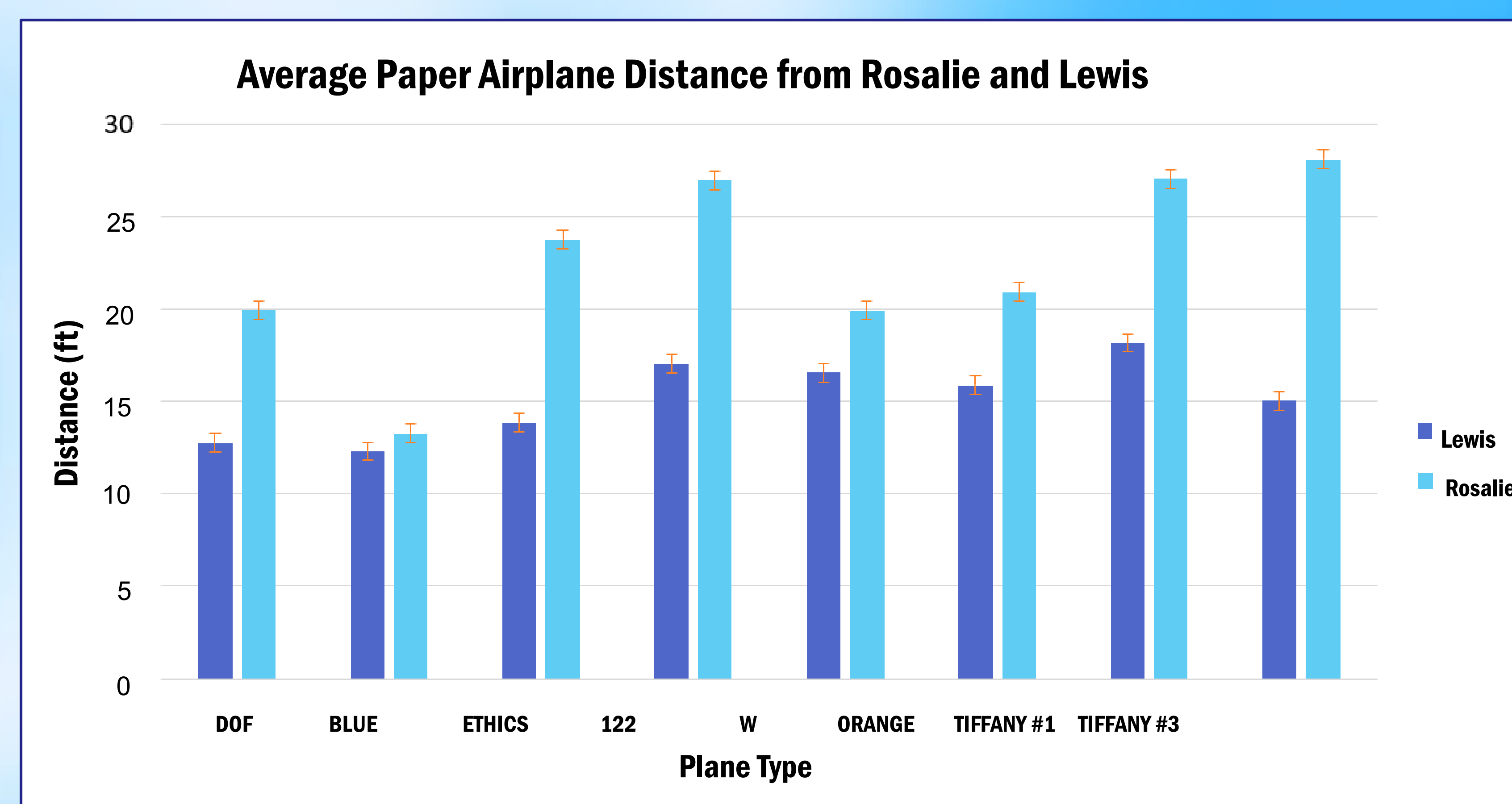


Figure 3: Average Paper Airplane Distance from Rosalie and Lewis

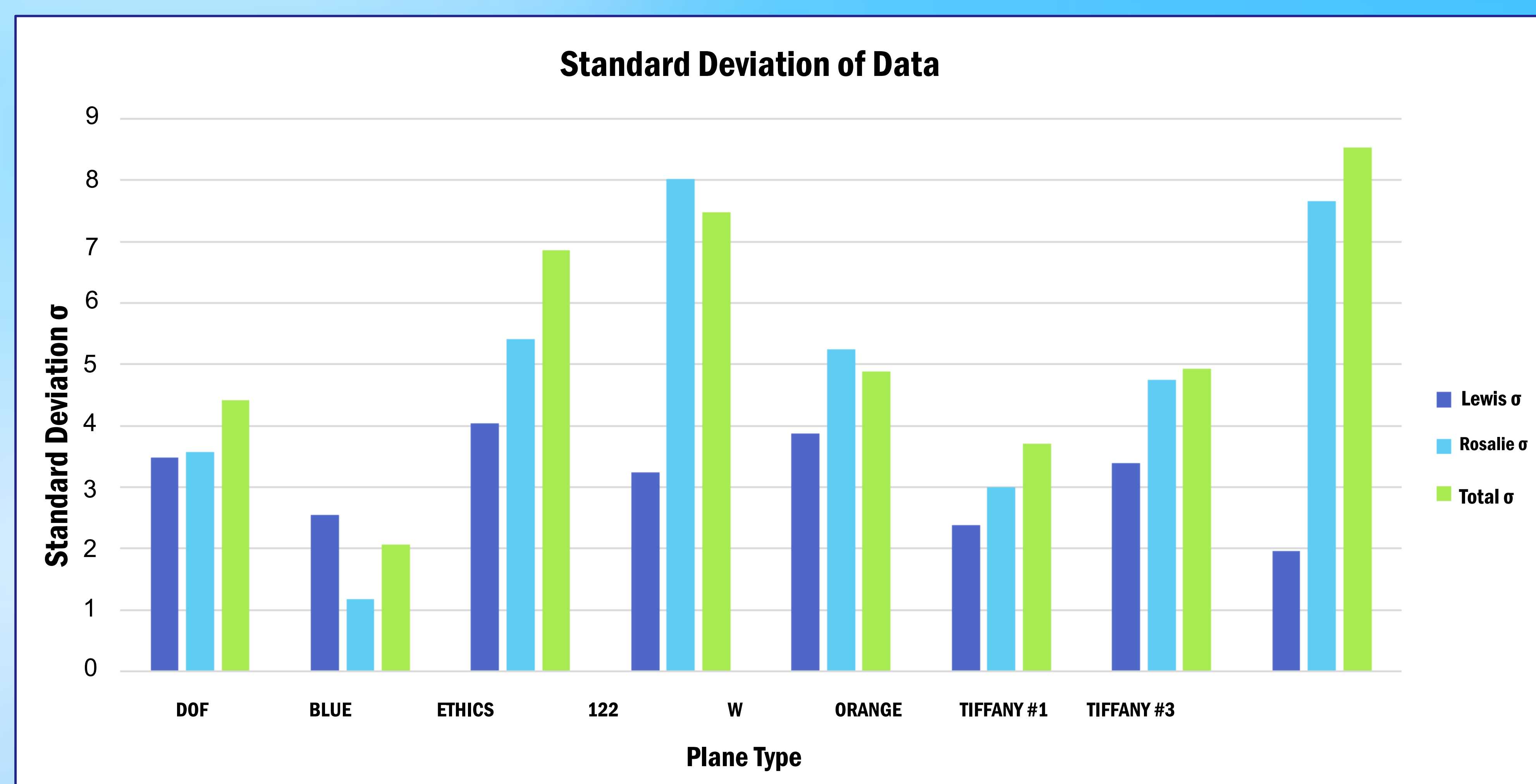


Figure 4: Standard Deviation of Data