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REVIEWER'S REPORT

Manuscript No.: **IJAR-53798** Date: 13.09.2025

Title: Clean Air Vs Dirty Air in Formula 1 Cars

Recommendation:
Accept after major revision .....

Rating	Excel.	Good	Fair	Poor
Originality		✓		
Techn. Quality			✓	
Clarity			✓	
Significance			✓	

Reviewer Name: Dr.K.Arumuganainar **Date:** 13.09.2025

Reviewer's Comment for Publication.
Decision: Major Revision Required

Reasons: The paper addresses an interesting problem but suffers from methodological weaknesses, incomplete validation, missing references, and anomalous results

Overall Evaluation:

The paper demonstrates good effort and engagement with CFD for motorsport aerodynamics but requires **significant revisions** to meet academic research standards. With improvements in methodology, data presentation, and literature grounding, it can become a solid technical contribution.

Detailed Reviewer's Report

Review Report

Title: **Clean Air Vs Dirty Air in Formula 1 Cars**

Manuscript ID: **IJAR-53798**

1. Originality and Relevance

The topic is relevant and timely, focusing on aerodynamics in Formula 1 (F1), specifically the effects of clean air vs. dirty air on drag, downforce, and performance. The study is meaningful for motorsport engineering, computational fluid dynamics (CFD) applications, and applied aerodynamics. However, originality is moderate since the issue of "dirty air" is well-studied in F1 literature. The paper's contribution mainly lies in its student-level simulation approach using Blender and ANSYS.

Strengths:

* Explores a practical and interesting engineering challenge.

* Relates CFD simulations to real-world racing performance.

* Connects results to racing strategies.

Weaknesses:

* The novelty is limited, as similar studies are widely available.

* Heavy reliance on pre-made 3D models reduces originality.

* The results contain anomalies that weaken conclusions.

2. Abstract

The abstract provides a concise overview of the problem, methodology, and objectives. However:

* It lacks **specific results or findings**.

* It should clearly state the **main conclusions** (e.g., reduced downforce, anomalies in drag).

* Language could be more technical and precise.

3. Introduction

The introduction establishes the importance of aerodynamics in F1 and the challenges posed by turbulence and dirty air. CFD is introduced as a cost-effective simulation method.

Strengths:

* Good explanation of drag, downforce, and turbulence.

* Sets context for why dirty air matters in racing.

Areas to Improve:

* The introduction is somewhat **descriptive** rather than analytical.

* Needs stronger **literature review** to connect with previous research in F1 aerodynamics.

* Could better highlight the **research gap** and what this paper uniquely contributes.

4. Methodology

The study uses Blender for 3D modeling and ANSYS for CFD simulation.

Strengths:

* Clear step-by-step explanation of modeling and simulation process.

* Practical approach using accessible tools.

Limitations:

* Reliance on a **premade 3D model** limits accuracy.

* No detailed description of **mesh quality, boundary conditions, or solver settings**.

* No validation of results with experimental or literature data.

* Heavy use of Google Sheets for comparison instead of robust statistical or CFD post-processing.

5. Results and Discussion

The results indicate:

* **Anomaly**: Dirty air drag values higher than clean air drag (contradicts real-world physics).

* Downforce and pressure reduction consistent with expectations.

* Explanation attributes anomaly to flaws in the 3D model (internal openings).

Strengths:

* Honest acknowledgment of anomalies and limitations.

* Logical explanation of expected vs. simulated behavior.

Weaknesses:

Results are too dependent on a flawed model, limiting reliability.

Lacks quantitative tables/graphs** directly in the paper (external Google Sheets link is not ideal).

Discussion of turbulence is qualitative with no detailed turbulence modeling approach.

6. Conclusion

The conclusion summarizes key findings:

Drafting reduces down force and pressure, increasing straight-line acceleration but reducing grip in corners.

Strategic recommendations are given for overtaking maneuvers.

Strengths:

Practical racing strategy insights are a nice addition.

Good connection between technical results and real-world applications.

Weaknesses:

Relies heavily on **assumptions due to anomalous data**.

Conclusion should clearly state **limitations** and suggest **future improvements** (e.g., better 3D models, turbulence models like k-ε, k-ω SST, LES).

7. Writing Quality and Presentation

Writing is **clear and simple**, but at times lacks academic depth.

Figures are mentioned but not well-integrated (captions incomplete).

External spreadsheet links should be avoided in formal reports.

References and citations are missing; the paper relies mostly on descriptive knowledge.

8. Recommendation

Decision: Major Revision Required

Reasons: The paper addresses an interesting problem but suffers from methodological weaknesses, incomplete validation, missing references, and anomalous results.

9. Suggestions for Improvement

1. Abstract: Add key results, numerical findings, and practical implications.

2. Introduction: Expand literature review with references to F1 aerodynamic studies.

3. Methodology:

Provide details on mesh quality, solver, turbulence models, and boundary conditions.

Avoid reliance on premade 3D models; develop a refined geometry.

4. Results:

Present graphs and tables directly in the paper.

Cross-check CFD results with published studies for validation.

Address anomalies with additional test runs or improved models.

5. Discussion:

Provide more technical explanation of turbulence effects.

Discuss limitations more critically.

6. Conclusion: Clearly state contributions, limitations, and future work.

7. References: Include relevant literature on F1 aerodynamics, dirty air studies, and CFD modeling.

8. Formatting: Improve figure captions, remove external links, and follow journal style guidelines.

Overall Evaluation:

The paper demonstrates good effort and engagement with CFD for motorsport aerodynamics but requires **significant revisions** to meet academic research standards. With improvements in methodology, data presentation, and literature grounding, it can become a solid technical contribution.