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The Aerodynamics design and Analysis of Hyper Loop Transportation System

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Abstract. *Hyper loop pods must be designed to minimize air resistance in order to achieve high speeds. This can involve using streamlined shapes and reducing the size of the vehicle to decrease its cross-sectional area. Velocity and pressure contours are used to evaluate the aerodynamic performance of the pod and identify areas of high drag, turbulence, or separation. Engineers can analyze the contours to identify areas of high or low pressure, which can affect the lift and drag forces acting on the pod. By optimizing the shape of the pods like Cuboidal,Flat-broad Bulge-broad Ellipsoidal. Using velocity and pressure contours in the design process can lead to a pod that is both fast and efficient, providing a safe and comfortable experience for passengers. The aerodynamic profile of the Nakatsu design is called a "Kammback" profile, . This profile features a teardrop-shaped body with a flat or truncated tail, which helps to reduce the size of the wake behind the vehicle and minimize drag.*

Key Words: *Hyper loop, Vacuum Tube, Aerodynamic track, Renewable Energy , Sustainability.*

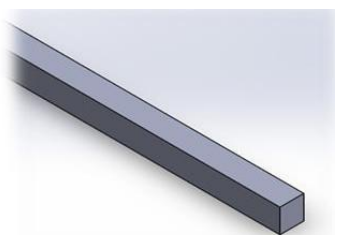
1. INTRODUCTION

Hyper-loop is a proposed mode of transportation which travels through a sealed tube. The design of the pods involves several factors, such as aerodynamics, weight, materials, and safety. Through our project, we will research and analyze different design options and use computer simulations to test the performance of the pods.

FIGURE1.

Our goal is to create pods that are both efficient and safe which can withstand the extreme environment.

1.1Pod 3d-models:



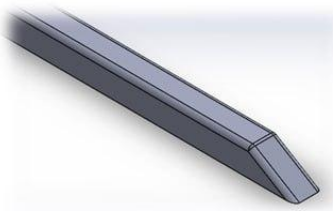


FIGURE 2. Cuboidal nose profile pod – Isometric

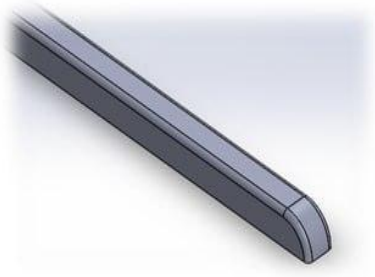


FIGURE 3. Flat-broad nose profile pod - Isometric

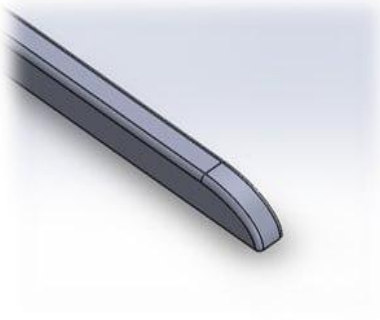


FIGURE 4. Bulge-broad nose profile pod – Isometric

FIGURE 5. Ellipsoidal nose profile pod - Isometric

2. AERODYNAMIC ANALYSIS

FIGURE 6. Cuboidal nose profile pod - velocity contours

FIGURE 7. Cuboidal nose profile pod - pressure contours

FIGURE 8.Flat-broad nose profile - velocity contours

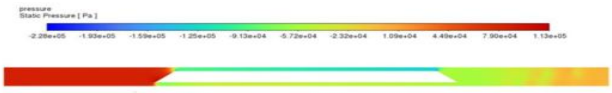


FIGURE 9.Flat-broad nose profile - pressure contours

FIGURE 10.Bulge-broad nose profile - velocity contours

FIGURE 11. Bulge-broad nose profile - pressure contours

FIGURE 12. Ellipsoidal nose profile pod - velocity contours

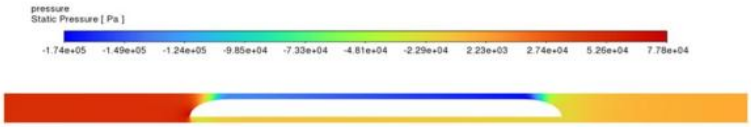


FIGURE 13. Ellipsoidal nose profile pod - pressure contours

Nose contours / Parameters	Cuboidal	Flat-broad	Bulge-broad	Ellipsoidal
Maximum Pressure (Pa)	2.23×10^5	1.13×10^5	8.60×10^4	7.78×10^4
Maximum Velocity (m/s)	863	674	634	633
Drag Force (KN)	3388.41	1398.920	885.39	806.45

Nakatsu's design: Kingfishers are birds that can dive from the air (low resistance) to water (high resistance) at speeds of up to 25 mph without making a splash.

FIGURE 14. Kingfishers are birds that can dive from the air (low resistance) to water (high resistance) at speeds of up to 25 mph without making a splash.

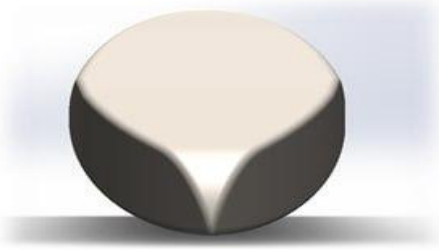


FIGURE 15. Front view of hyperloop pod with Nakatsu design

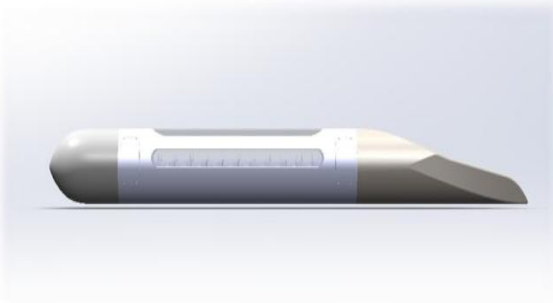


FIGURE 16. Right-side view of hyperloop pod with Nakatsu design

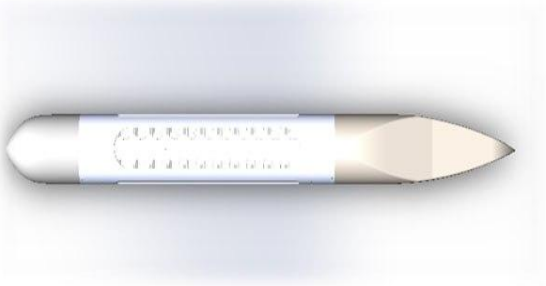


FIGURE 17. Top view of hyperloop pod with Nakatsu design

FIGURE 18. The aerodynamic profile of the Nakatsu design is called a "Kammback" profile, also known as a "Kamm tail" or "K-tail".

3. ADVANTAGES

3.1High Speed: The vacuum train has the potential to reach incredibly higher speeds, up to 760 miles per hour. This is much faster than traditional modes of transportation such as cars, trains, and planes.

3.2Energy Efficiency: The vacuum train has the potential to be very energy efficient, using less energy per passenger mile than cars or planes. This is because it is propelled by magnetic levitation and has little air resistance due to the vacuum inside the tube.

4. DISADVANTAGES

4.1High Cost: Building an Hyper loop vacuum train system can be expensive due to the advanced technologies are involved. While the technology is becoming more widely used, although it is available and the costs are coming down, it is still a major investment.

*4.2L**imited Capacity:*** The Hyperloop vacuum train system is designed to transport Small numbers of people and cargo over short distances. This means that it may not be practical for long-distance travel or moving large amounts of freight.

5. APPLICATIONS

5.1Environmental benefits:. The train runs on electricity, which is a clean source of energy. The train can also reduce the number of vehicles on the road, reducing greenhouse gas emissions and improving air quality.

5.2 High-speed transportation: By offering high-speed travel that can reduce journey times by a significant margin. With the capacity to reach speeds of up to 700 mph.

REFERENCES

[1]. Roy, P. C., Rahman, A., & Halder, M. R. (2022). Numerical Investigation of Aerodynamic Characteristics of Hyperloop System Using Optimized Capsule Design. International Journal of Automotive and Mechanical Engineering, 19(4), 10132-10143.

[2]. The fifth mode of transportation: Hyperloop, Kemal Armagana, a Department of Civil Engineering, KaramanogluMehmetbey University, Karaman, Turkey. July 2020, Journal of Innovative Transportation, 1(1), 1105.