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HYPERLOOP- A CASE STUDY

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ABSTRACT: Currently, the conventional modes of transportation consist of four unique types: rail, road, water, and air. Hyperloop is a new mode of transport that is both fast and inexpensive for people and goods.

Hyperloop consists of a low pressure tube with capsules that are transported at both low and high speeds throughout the length of the tube. The capsules are supported on a cushion of air, featuring pressurized air and aerodynamic lift. The capsules are accelerated via a magnetic linear accelerator affixed at various stations on the low pressure tube with rotors contained in each capsule. Passengers may enter and exit Hyperloop at stations located either at the ends of the tube, or branches along the tube length.

Hyperloop project is being constructed under the flagship of Elon Musk's transportation venture "The Boring Company". Also, companies like Virgin Hyperloop One and Hyperloop Transportation Technology have begun their work in different countries. Many big investors have invested in this futuristic project.

In India, many companies have shown interest in this project. But there is a valid debate over the question that whether it is viable for India to show a green flag to a "magnificent" project like this than thinking about improving roadways and railways and other infrastructure and technology.

KEYWORDS: -Hyperloop, Virgin hyperloop, Transportation, Magnificent, Infrastructure.



I. INTRODUCTION

- "Hyperloop" is a concept proposed by Space X and Tesla founder Elon Musk for a fast-paced trip between cities. Using travel pods inside metal tubes, calling it the "fifth mode" of transport over cars, planes, boats and trains.
- His concept of hyperloop travel was first introduced by Robert H Goddard in 1904.
- Hyperloop is a high-speed transport system that can reach speeds of up to 750 mph (1,210 mph). Musk's first design was to take people from the city of Los Angeles to San Francisco in 30 minutes - a distance of 380 km (610 km).



- It works by pushing specially designed pods or tablets using electromagnetic force inside a tube near the vacuum to reduce air collision and suction.
- The pods run over the air cushion inside the tube using rails that are specially designed in the same way as maglev (short magnetic rotation) trains that are pushed away from the tracks and forward using electric magnets. The electric compressor in front of the pod pushes air back.
- Hyperloop One has partnered with Richard Branson who used its competitive tenders to plan Hyperloop routes in Canada, India, Mexico, and the UK. Its US routes include Chicago to Pittsburgh and Cheyenne via Denver, to Pueblo in Colorado.
- Its competitor is part of Hyperloop Transportation Technologies sponsored by the crowd. Agreements to develop Hyperloop routes in China, Indonesia, South Korea, France, and the Czech Republic have been signed and the company has announced the construction of what is likely to be the world's first commercial system from Abu Dhabi to Dubai in the UAE from 2019.

Factors/Projects	China	USA	Dubai
Route	Tongren's to Mount Fanjing	Los Angeles to San Francisco	Dubai to Abu Dhabi
Cost (USD)	1.5 billion	60-70 billion	20-40 billion
Length (Km)	65	559	105
Duration (Minute)	6 min.	43 min.	12 min.



Virgin Hyperloop

Virgin Hyperloop (known as Hyperloop Technologies, Hyperloop One and Virgin Hyperloop One) is an American high-speed transportation technology company called Hyperloop. The company was founded on June 1, 2014 and was restructured and renamed on October 12, 2017.

Hyperloop systems are designed to transport passengers and / or goods at flight speeds in part to air travel costs. They are designed such that it works by a suspended magnetic system in a vacuum tube. The real concept of Hyperloop is to propound the use of a line electric motor to accelerate and decelerate a levitated pod in a low pressure tube. The vehicle was flying silently at speeds of up to 760 mph (1223.1 km / h) with very low turbulence. The system is proposed to be completely independent, quiet, direct-to-distance and on demand. As it is proposed to be built over columns or an underground tunnel, it will eliminate cross-sectional hazards and require fewer road rights than a high-speed railway line or highway. Virgin Hyperloop made major technical changes to Elon Musk's original proposal and chose not to follow the Los Angeles-to-San Francisco route thought by Musk in his white alpha-design paper 2013.

The company raised \$ 295 million on December 18, 2017 and demonstrated the type of propulsion technology on May 11, 2016 at its North Las Vegas checkpoint. It completed the 500-meter Development Loop (DevLoop) and on May 12, 2017, held its first complete test. The test included Hyperloop components including vacuum, propulsion, levitation, sled, control systems, tubes and structures. As of May 2019, the company had raised \$ 400 million.

It has stated that the goal is to launch a commercial operation by 2030.



II. FUNDING

Between June 2015 and December 2015, the company continued to hire engineers and expanded its downtown campus (now up to 75,000 square feet). In December 2015, the newly renamed Hyperloop One announced that it would be conducting an open air test at the new Nevada testing and safety facility. At the time, the company disclosed that it had raised \$ 37 million so far and completed an \$ 80m Series B cycle, which it closed in May 2016. In October 2016, the company announced it had raised another \$ 50 million, led by investment from DP World.

An open-air propulsion test, or POAT, was successfully held in North Las Vegas on May 11, 2016. The POAT slide reached 134 mph (216 km / h) in 2.3 seconds, indicating significant evidence of concept. At that time Hyperloop One announced that it had secured partnerships with international engineering and design firms such as AECOM, SYSTRA, Arup, Deutsche Bahn, General Electric, and Bjarke Ingels.

On November 10, 2016, Hyperloop One released its first system designs in partnership with Bjarke Ingels Group.

On October 12, 2017, Hyperloop One and Virgin Group announced they had developed an investment relationship, which led to Richard Branson joining the board of directors. The global strategic partnership will focus on passengers and mixed goods service in addition to building a new passenger class. Later, Hyperloop one was renamed Virgin Hyperloop One, and Branson chaired the board of directors.

In June 2020, the company was renamed Virgin Hyperloop, changed its logo and launched a new website.

Hyperloop Transportation Technologies (HTT)

Hyperloop Transportation Technologies, also known as HyperloopTT, is an American research company built using a collaborative approach (group combination and crowdsourcing) to develop global Hyperloop-based commercial transport systems.

Although Elon Musk has proposed the concept, he is not affiliated with HyperloopTT. The project was to build a high-speed, downtown vehicle using a low-pressure train that will reach a speed of 800 miles per hour (1,300 km / h) carrying 15 million passengers a year.

HyperloopTT also plans to build slow-moving, mid-city Hyperloops.

Employee Growth

One co-operative model meant that instead of employees, HyperloopTT has established a network of all contributors who work at least 10 hours a week to find a balance in the future.

The first upgrade was made by nearly 100 engineers who were compensated for the stock options alone. This first group was based within the United States. The company has assembled a team of community members, attracting top engineers and contributing companies.

HyperloopTT saw a significant increase in contributor numbers in 2015, in February the company grew to nearly 200 participants and in November more than doubled to just fewer than 500 people.

HyperloopTT continued to grow and began hiring full-time managers, to help manage the contribution of the crowd.

Today, HyperloopTT boasts more than 800 providers in 40 countries with 50 full-time employees and more than 50 corporate partners.

Funding

In 2016, HyperloopTT had raised \$ 31.8 million and received \$ 77 million per hour for people, services provided, and land use rights and future investment.

The HyperloopTT collaboration model has enabled major development with very small financial resources compared to competitors. Forbes' 2020 article stated that HyperloopTT has received a total investment of \$ 50 million since its

inception, a relatively small amount compared to Virgin Hyperloop's \$ 350 million. Despite the differences in investment, the HyperloopTT's Great Lakes project is the closest Hyperloop project to operation.

HYPERLOOP IN INDIA

India is the 2nd most populous country in the world with a population of 140 cores. It is a developing country and is undergoing many infrastructural developments. There are 4 main metro cities, viz. Mumbai, Delhi, Chennai and Kolkata. These cities have a huge contribution in development and GDP of the country. Millions of people live here and work here for livelihood to make ends meet.

In this globally connected era, the need of faster transportation is an important factor to analyze development of a country. Hence, Hyperloop in India could be used as a great option to link India's industrial and metropolitan cities.

Virgin Hyperloop proposed to build a hyperloop project to link Mumbai and Pune, which are among India's busiest cities. Many domestic and international companies reside in these cities. The cities are already linked by railways, airways and roadways (roadways include NH48 and Mumbai Pune expressway), but there is still a need of faster transportation between these two cities. The Hyperloop project is proposed along the Mumbai-Pune expressway. The length of route is estimated to be 94.5 km. The duration of travel would be reduced from 1 hr. 17 min (by car) and 3 hr. 10 min (by air) to just 13 min (using hyperloop).

Topography of the route

Pune side of the route consists of high altitude of about 500-700m elevation. While moving toward Mumbai, the elevation drops around 20m.

Political Aspect

A Niti Aayog document, accessed by the *PTI*, says that in view of the emerging transport technology and for gaining the first-mover advantage, it is essential to look into the technological and commercial viability of the Virgin Hyperloop technology. It is relevant to explore technological, commercial, financial (viability) and (assess) safety standards and regulations to procure new technology. It has been decided to constitute an Expert Committee, the document says. The committee has NITI Aayog member V.K. Saraswat as its Chairman and Adviser (Infrastructure Connectivity, NITI Aayog) Sudhendu Jyoti Sinha as its convener.

While, the state government of Maharashtra (before 2019) has shown interest in this project. Former Maharashtra Prime Minister Devendra Fadnavis even visited the Devloop area in Dubai. But in 2019, the government changed. The new Deputy Prime Minister Ajit Pawar said, "Let it happen elsewhere. Let it be a success for at least 10 kilometres abroad," Ajit Pawar told reporters, according to the Press Trust of India news agency. "We do not have the capacity to test the Hyperloop.



Maharashtra EX-Chief Minister Devendra Fadnavis visited the Hyperloop test site in the US.



III. CONCLUSION

The technological upgradation is a necessity of humankind. The evolution of science for millions of years has brought us to the state where we are today. This has shown us many good and bad inventions, hyperloop is one of it. So, this new mode of transportation seems to be just an enhanced version of maglev trains. The hyperloop is nothing utopian concept, but just an advancement in faster trains.

In context to India, Hyperloop can be a major leap in transportation system. There are many basic necessities like better roads and better facilities in trains etc. that the public is abstained from even today. The critics say that the fund for project can be utilized to improve the existing modes of transportation. While the people in favour of it think that the project is a key factor to make the country from developing to a developed nation.

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