

HYPERLOOP

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Summary. Hyperloop is a new form of ground transport currently in development by a number of companies. It is seen to be cheaper and faster than train or car travel, and cheaper and less polluting than air travel. Hyperloop technology is still in development even though the basic concept has been around for many years, however the earliest any Hyperloop is likely to be up and running is 2030. It's still not clear where Hyperloops will actually be established but a number of companies have sketched out routes in the US, Europe, and elsewhere. Potential routes include New York to Washington DC, Paris to Helsinki, Pune to Mumbai, Kansas City to St Louis, Bratislava to Brno, Vijaywada and Amaravati.

Key-words: tube, transportation, vacuum, air pressure, viability, future.

Hyperloop is a new futuristic transportation method pitched by US entrepreneur *Elon Musk* (Fig. 1) and currently in development by a number of companies, it could see passengers travelling at over 1 200 km/h in floating pod which races along inside giant low-pressure tubes, either above Sahara's deserts, in the ocean with dolphins or below European crowded cities.

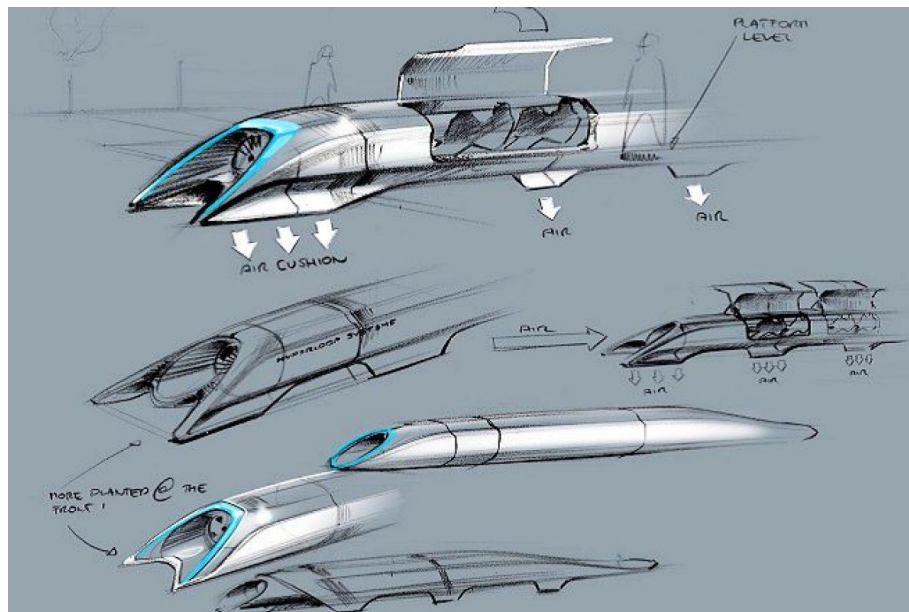


Fig. 1 Sketches of Elon Musk's Hyperloop

Engineers say - the technology is more sustainable than aviation and significantly faster than trains. But is *Hyperloop* really a viable future transportation method and can this concept become a reality?

Will we really be able to see one of these high-tech vehicles any time soon? Or maybe to travel on the board of it?

Hyperloop's roots lie well in the past. Chris Dulake says: "It is not a new concept, the notion of vacuum transportation's been around for quite some time" ^[1]. *Elon Musk's Hyperloop* concept operates by sending specially designed "capsules" or "pods", which floats on 0.5–1.3 mm layer of air provided under pressure to air-caster "skis", similar to air hockey, through a steel tube maintained at a partial vacuum (Fig. 2). *Hyperloop One's* technology uses two sets of magnets: one set to repel and push the train up off the track, and another set to move the elevated train ahead, for the same purpose.

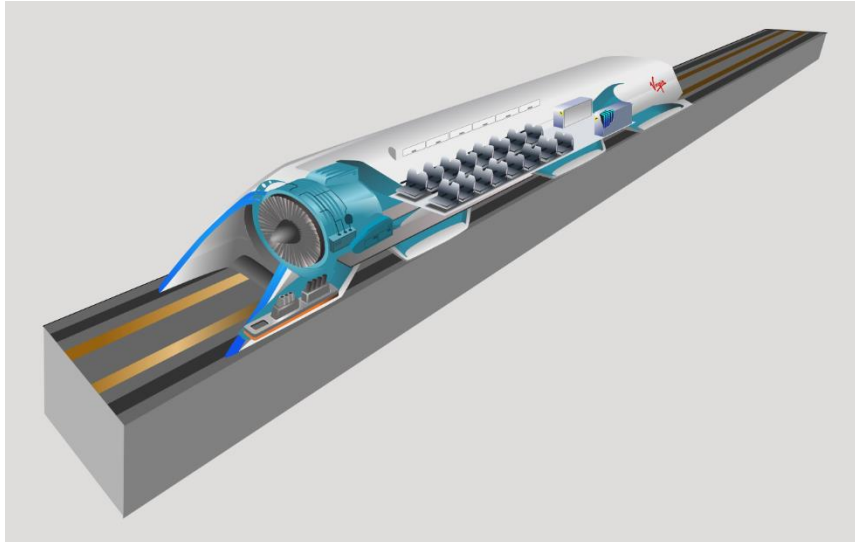


Fig. 2 Concept art of Hyperloop inner workings

In *Musk's* original *Hyperloop* concept (Fig. 3), an electrically driven *inlet fan* and *axial compressor* would be placed at the nose of the capsule to "actively transfer high-pressure air from the front to the rear of the vessel", solving the problem of air pressure building in front of the vehicle, slowing it down. A fraction of the air is shunted to the skis for additional pressure. The fan works on alternative energy, such as solar and wind.

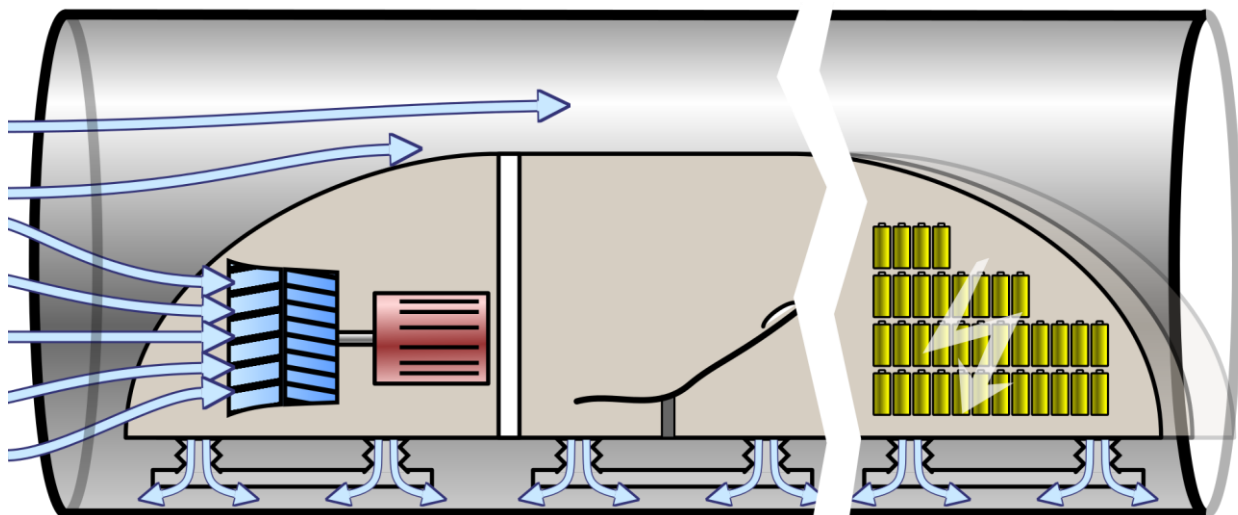


Fig. 3 Axial compressor on the front, passenger compartment in the middle, battery compartment at the back, and air caster skis at the bottom.

Passenger-only pods are to be 2.23 m in diameter and are projected to reach a top speed of 1 200 km/h . The design proposes passengers experience a maximum inertial acceleration of 0.5 G, about 2 or 3 times that of a commercial airliner on takeoff and landing.

Americans will be first to travel at the speed of 1 200 km/h. The route Interstate 5 is like an introductory of big international web system of routes, which would give opportunity to go from city A to B, at a max speed of 1 200 km/h in about 2 hours instead of two to three days depending on traffic and costumes. An international sytem (Fig. 4) is going to be developed together by all companies like *TransPod*, *Virgin Hyperloop*, *Arrivo DGWHyperloop* etc.

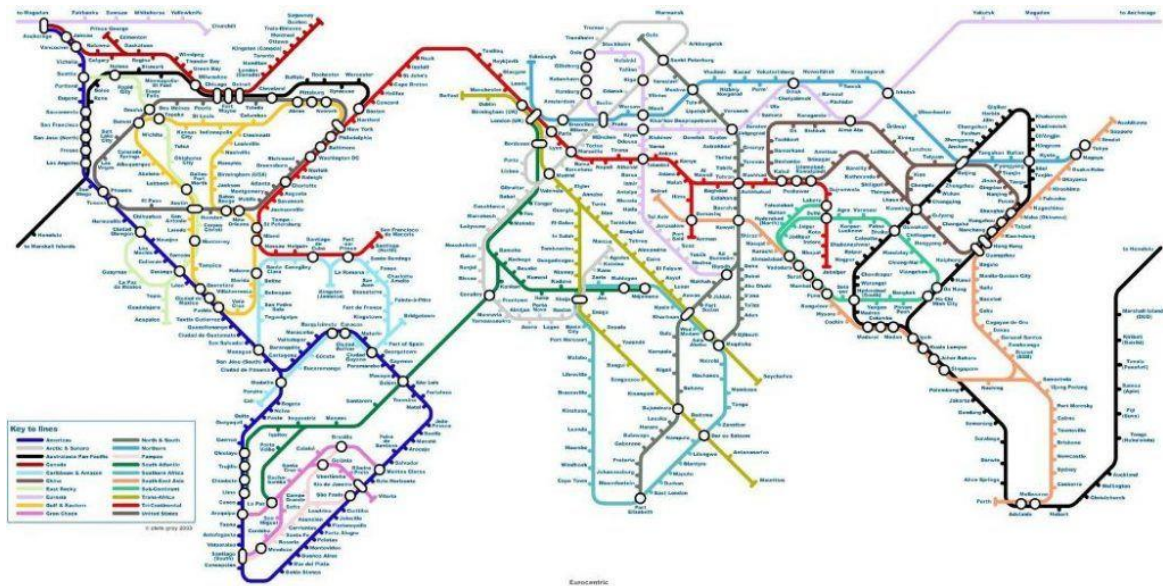


Fig. 4 Prototype Hyperloop conection

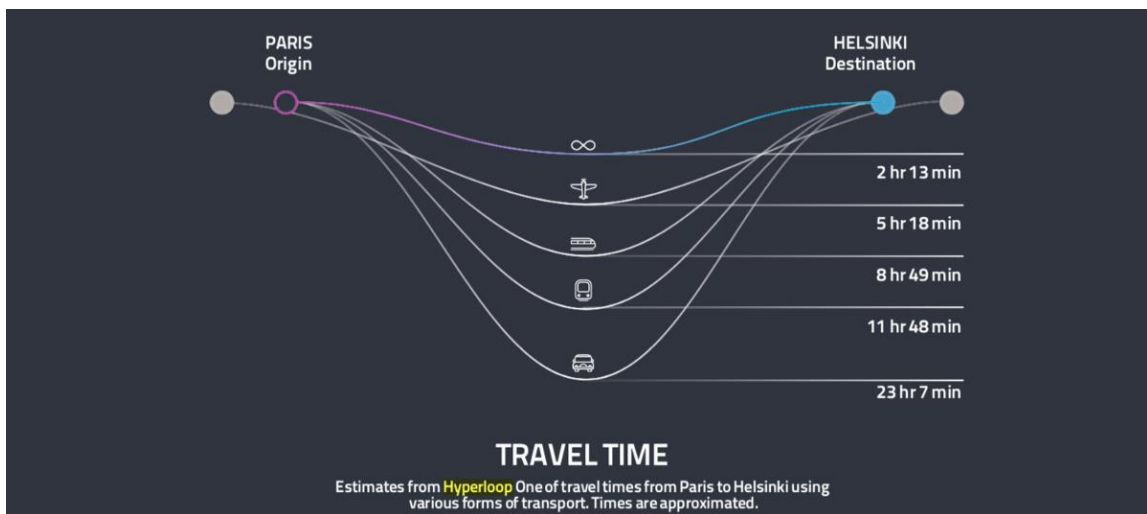


Fig. 5 Travel Time Paris-Helsinki 2 704 km

What about Challenges? The Hyperloop companies are all vey confidet in their projects' viability. "We all know that the tech works, right, the physics works" [2] says Kelly from Virgin Hyperloop. The challenge is more on the political side, to convince a government in the demand of this innovation. Risks must be taken.

When will this happen? So just how close we are to Hyperloop? *Virgin Hyperloop One* built first full-size pod back in 2017 and has reached speeds of 387 km/h on a test track in Nevada. In June 2019, *Hardt Hyperloop* announced the opening of a test facility, and distant long term plan to develop a Europe-wide transportation system. *TransPod*, meanwhile, is working on feasibility studies and construction of a test track. Kelly from *Virgin Hyperloop* says: "The company is hoping certification will be concluded by 2023 with a service up and running by 2029" [3]. Gendron says *TransPod* wants certification by 2025 [4]. What is important, private finance will be a necessity due to high costs. *Tab. 1.*

Tabel 1

The costs of a Hyperloop according to Elon Musk's Hyperloop Alpha paper.^[5]

<i>Component</i>	<i>Cost (million USD)</i>
<i>Capsule</i>	<i>54 (for 40 capsules)</i>
Structure & Doors	9.8
Interior & Seats	10.2
Compressor & Plumbing	11
Batterie & Electronics	6
Propulsion	5
Suspension & Air Bearing	8
Assembly	4
Tube	5 410
Tube construction	650
Pylon construction	2 550
Tunnel construction	600
Propulsion	140
Solar panels & Batteries	210
Station & Vacuum pumps	260
Permits & Land	1 000
Cost margin	536
Total	6 000

Probably, 2030 is the earliest term. So, in 10 years time, we might find ourselves speeding across the surface of the planet in a metal tube, below or above the gorund like hamsters.

References

Web References:

1. <https://en.wikipedia.org/wiki/Hyperloop>;
2. <https://edition.cnn.com/travel/article/how-long-hyperloop/index.html> ^{[1]-[4]};
3. <https://www.zdnet.com/article/what-is-hyperloop-everything-you-need-to-know-about-the-future-of-transport/> ^[5].